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# SELECTED **WATER RESOURCES ABSTRACTS**



VOLUME 11, NUMBER 24  
DECEMBER 15, 1978

W78-12101--W78-13000  
CODEN: SWRABW

**SELECTED WATER RESOURCES ABSTRACTS** is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce, for the Water Resources Scientific Information Center (WRSIC).

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# FOREWORD

# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,  
U.S. Department of the Interior



**VOLUME 11, NUMBER 24**  
**DECEMBER 15, 1978**

W78-12101--W78-13000

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

**A**s the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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## FOREWORD

**Selected Water Resources Abstracts**, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

**Selected Water Resources Abstracts** is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center  
Office of Water Research and Technology  
U.S. Department of the Interior  
Washington, DC 20240

# CONTENTS

FOREWORD ..... iii

## SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

### 01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions

### 02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

### 03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

### 04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

### 05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

### 06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

### 07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

### 08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

### 09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

### 10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

## SUBJECT INDEX

## AUTHOR INDEX

## ORGANIZATIONAL INDEX

## ACCESSION NUMBER INDEX

## ABSTRACT SOURCES

2. WA

2A. Ge

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SIMULA  
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W78-1221

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W78-122

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W78-122

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Wetland  
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W78-122

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# SELECTED WATER RESOURCES ABSTRACTS

## 2. WATER CYCLE

### 2A. General

**THE APPLICATION OF A SURFACE CLIMATE SIMULATOR TO MONTEZUMA WELL, ARIZONA,**  
Arizona State Univ., Tempe.  
For primary bibliographic entry see Field 2B.  
W78-12217

**STOCHASTIC MODELING OF WATERSHED SYSTEMS,**  
Illinois Univ. at Urbana-Champaign.  
V. T. Chow.  
In: *Advances in Hydrosceince*, Vol. 11, 1978, p 1-93. 52 fig, 9 tab, 37 ref. B-060-ILL(9).

Descriptors: \*Watersheds(Basins), Runoff, Water yield, Hydrologic systems, \*Hydrologic models, \*Stochastic hydrology, \*Model studies, \*Stochastic processes.

Discussion is presented of the approximation of hydrologic systems by modeling. The simulation of a watershed as a hydrologic system can be deterministic, quasi-stochastic, or stochastic. A quasi-stochastic system treats the input and output as stochastic while the system through which the throughput passes is deterministic. The theory and examples to model lumped quasi-stochastic and stochastic watershed systems are given.  
W78-12264

**EXTENSION OF THE HISARS SYSTEM,**  
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.  
For primary bibliographic entry see Field 7C.  
W78-12276

**SIMULATED HYDROLOGIC EFFECTS OF CANALS IN BARATARIA BASIN: A PRELIMINARY STUDY OF CUMULATIVE IMPACTS,**  
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.  
For primary bibliographic entry see Field 2L.  
W78-12309

**DEVELOPMENT OF DRAINAGE BASIN-ESTUARY NUMERICAL MODEL SYSTEM FOR PLANNING OF THE COASTAL ZONE,**  
Florida Univ., Gainesville. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2L.  
W78-12316

**MATHEMATICAL MODELS FOR SIMULATING MONTHLY WATER LEVELS AND SALINITIES IN SHALLOW LAKES,**  
University of the Witwatersrand, Johannesburg (South Africa).  
For primary bibliographic entry see Field 2L.  
W78-12411

**AN ADAPTIVE ALGORITHM FOR ANALYZING SHORT-TERM STRUCTURAL AND PARAMETER CHANGES IN HYDROLOGIC PREDICTION MODELS,**  
Princeton Univ., NJ. Dept. of Civil Engineering.  
E. F. Wood, and A. Szollosi-Nagy.  
Water Resources Research, Vol. 14, No. 4, p 577-581. August 1978. 7 fig, 34 ref, 1 append.

Descriptors: \*Rainfall-runoff relationships, \*Simulation analysis, \*Forecasting, \*Input-output analysis, \*Algorithms, \*State space formulation, Environmental effects, Mathematical models, Behavior, Floods, Equations, Systems analysis, Random walk, Kalman filters, Ombone River

basin(Italy), Noise covariances, Optimal operation.

An adaptive unbiased recursive prediction algorithm, based on the state space description of hydrologic systems, is discussed. Discrete linear systems with white Gaussian disturbances are considered. The algorithm allows for short-term structural and parameter changes due to random environmental effects. A prediction model is set up from a representation of the rainfall-runoff processes with the unknown parameters modeled by a random walk. The predictions are obtained by the use of linear Kalman filters where the unknown noise covariance matrices are also adaptively estimated. The behavior of the adaptive prediction algorithm is illustrated by a real-world example taken from rainfall-runoff flood forecasting. (Bell-Cornell)  
W78-12551

**EVALUATION OF DETENTION BASINS FOR CONTROLLING URBAN RUNOFF AND SEDIMENTATION,**  
Kentucky Water Resources Research Inst., Lexington.  
C. T. Haan, and A. D. Ward.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 965. Price codes: A03 in paper copy, A01 in microfiche. Research Report No. 112, August 1978. 20 p, 4 fig, 11 ref. OWRT B-046-KY(3), 14-34-0001-6081.

Descriptors: \*Detention basins, Urban hydrology, \*Storm water, Management, \*Sediment basins, Simulation analysis, \*Urban runoff control, System analysis, Model studies, Sediment control.

The main project accomplishments were: (1) a demonstration of the desirability of considering systems of urban stormwater detention basins as opposed to individual basin design, (2) the development of a system analysis approach for least cost selection of a system of detention basins for meeting a preset hydrologic objective, (3) the development of a mathematical, computer-based simulation model of the performance of sediment retention basins, (4) partial verification of the sediment basin model and (5) the development of design recommendations for sediment basins based on simulations made with the sediment basin model. (Huffsey-Kentucky)  
W78-12608

**TRANSITION ZONES OF FORESTED INLAND WETLANDS IN NORTHEASTERN CONNECTICUT,**  
Connecticut Univ., Storrs. Inst. of Water Resources.  
For primary bibliographic entry see Field 6G.  
W78-12609

**DIGITAL MODEL OF GROUND-WATER FLOW IN THE PICEANCE BASIN, RIO BLANCO AND GARFIELD COUNTIES, COLORADO,**  
Geological Survey, Lakewood, CO. Water Resources Div.  
For primary bibliographic entry see Field 2F.  
W78-12731

**INVENTORY OF WATER RESOURCES RESEARCH IN AUSTRALIA, 1976.**  
Australian Water Resources Council, Canberra. Dept. of National Resources.  
Australian Government Publishing Service, Canberra, 1976. 137 p, 1 append.

Descriptors: Water resources, \*Research and development, \*Projects, \*Australia, Bibliographies, Census, Abstracts, Water sources, Groundwater, Surface waters, Water pollution, Water quality, Data collections, Data processing, Hydrology, Hydraulics, Meteorology.

The Inventory of Water Resources Research in Australia 1976 is issued on behalf of the Australian Water Resources Council. The Inventory covered research into water resources and directly related matters, and it included research projects in progress during the calendar year 1976. The information included in the Inventory was sought by means of a letter circulated to 265 research units in March 1976. For the purpose of the Inventory, a research project was defined as one which is designed to reveal new principles, techniques, or methods, to make comparative studies or to determine applicability in new situations. The basis of the Inventory was the collection of 'Project Details' which are in the form received from co-operating research units. The 'Subject Index' was based on the provision of up to 5 subject index terms for each project. The section 'Classification of Projects by Water Resources Research Categories' listed project titles in accordance with the 'Water Research Categories' (and sub-categories) of the USI Federal Council for Science and Technology. Details of categories were included in Appendix I. The 'Research Personnel Index' listed alphabetically all research personnel cited in the Inventory and the projects with which they are involved. (See also W76-02680) (Froehlich-ISWS)  
W78-12833

**THE FRESHWATER REGIME OF FAXAFLOI, SOUTHWEST ICELAND AND ITS RELATIONSHIP TO METEOROLOGICAL VARIABLES,**  
Iceland Univ., Reykjavik; and Marine Research Inst., Reykjavik (Iceland).  
For primary bibliographic entry see Field 2L.  
W78-12834

### 2B. Precipitation

**MARKOV PROCESS FOR SIMULATING DAILY POINT RAINFALL,**  
Booker Associates, Inc., Lexington, KY.  
D. I. Carey, and C. T. Haan.  
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. 1R1, Proceedings Paper 13631, p 111-125, March 1978. 2 fig, 11 tab, 9 ref, 1 append. OWRT A-045-KY(3) and A-052-KY(5).

Descriptors: \*Rainfall, \*Model studies, \*Markov processes, \*Kentucky, Mathematical models, Simulation analysis, Rainfall simulators, Simulated rainfall, Rainfall intensity, Synthetic hydrology, Rain, Precipitation(Atmospheric), Runoff, Storage, Reservoirs, Estimating equations, Hydrology, Meteorology, Climatology.

A modified Markov Chain model was used to generate synthetic traces of daily rainfall amounts at a point. Mixed discrete-continuous distributions were used to model the state transition probabilities. The use of the modified model affords a considerable reduction in historical data requirements for parameter estimation. A two-parameter gamma distribution was used in the model with data from 7 weather stations in Kentucky and provided a good representation of the daily point rainfall process. (Sims-ISWS)  
W78-12119

**THE APPLICATION OF A SURFACE CLIMATE SIMULATOR TO MONTEZUMA WELL, ARIZONA,**  
Arizona State Univ., Tempe.  
A. J. Brazel.  
Journal of the Arizona Academy of Science, Vol 12, No 1, p 29-35, Feb 1977. 3 tab, 3 fig, 10 ref.

Descriptors: \*Model studies, \*Arizona, \*Montezuma Well(Ariz), \*Simulation analysis, Thermal water, \*Microclimatology, Artesian wells, Air-earth interfaces.



## Field 2—WATER CYCLE

### Group 2B—Precipitation

This paper describes a microclimatic model developed for Montezuma Well, focusing on the interaction of the radiative properties of the landscape and the resulting diurnal amplitude and phase parameters of radiant temperatures of the air-ground interface. The model agrees with field data for amplitude and phase parameters at five sites investigated, but a more sophisticated model is required to obtain precise spatial estimates of surface temperatures each hour during a clear sky diurnal period. (Russell-Arizona)  
W78-12217

**PRECIPITATION CLIMATOLOGY FOR THE TEXAS HIGH PLAINS,**  
Texas Tech Univ., Lubbock. Dept. of Geosciences.  
For primary bibliographic entry see Field 3B.  
W78-12221

**COMPUTER PROGRAM FOR CALCULATING ATMOSPHERIC PLANETARY WAVES,**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
For primary bibliographic entry see Field 7C.  
W78-12254

**EXTENSION OF THE HISARS SYSTEM,**  
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.  
For primary bibliographic entry see Field 7C.  
W78-12276

**CLIMATOLOGY, HYDROLOGY, AND HYDROGRAPHY OF THE VERMILION BASIN. SYNOPSIS WEATHER TYPES AND ENVIRONMENTAL RESPONSES. HYDROLOGIC AND HYDROGRAPHIC PROCESSES,**  
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.  
For primary bibliographic entry see Field 2L.  
W78-12308

**DENDROCLIMATOLOGY IN SOUTH AFRICA,**  
University of the Witwatersrand, Johannesburg (South Africa).  
J. F. Gillooly.  
South African Forestry Journal (Pretoria) Vol. 98, 1976. 1 fig, 5 ref. p 64-65.

Descriptors: \*Dendroclimatology, \*Climatic data, \*Rainfall patterns, Hydrologic cycle, Weather forecasting, Future planning, \*South Africa.

Climatic observations in South Africa extend for a relatively short period back in time, generally covering a period of no more than 60-70 years. For this reason any natural phenomenon, linked to climate may prove useful in elucidating past climatic states. On such phenomenon is the annual growth pattern in woody plants, the study of which when used for determining the variability in present and past climates is called dendroclimatology. The method used in the above study is to extract cores from several old trees in an area and measuring ring widths with a traveling microscope. If, by extending the climatic record back in time, the known oscillatory annual rainfall behaviour patterns can be shown to be persistent through time, future longterm weather predictions can be made with some degree of confidence. (So Afr Water Info Ctr)  
W78-12409

**GETTING WISE TO THE WEATHER.**  
Scientiae, Vol. 16, No. 6, p 10-17, 1975.

Descriptors: \*Climatology, \*Weather patterns, \*Meteorology, Weather data, Forecasting, Rainfall modification, Droughts, Seasonal variations, Satellites, Topographic influences, Mathematical models, Humidity, Wind direction, Orographic in-

fluences, Thermocline, Atmospheric conditions, Agulhas current, Gough island, Bouvet island, Atlantic Ocean, \*South Africa.

Average losses caused by the weather in Southern Africa are in the region of 23 per cent of annual production or approximately R285 000 000. A large proportion of these losses could be prevented if better use were made of the weather services available. The article describes the research dam in South Africa as trying to find out more about general weather patterns, to understand more about the weather and to be able to predict it more accurately. To enable them to get information from far beyond this country's borders, South African scientists are preparing to take part in the Global Atmospheric Research Program (GARP). With its extended facilities and South Africa's envisaged participation in the GARP programme, the country is on the brink of exciting developments in weather forecasting and there are numerous opportunities for new research projects and for the extension of present work on meteorology. (So Afr Water Info Ctr)  
W78-12425

**CORN YIELD - AN EARLY WARNING SYSTEM,**  
T. G. Dyer, and J. F. Gillooly.  
South African Journal of Science, Johannesburg, Vol 73, No 8, p 252-253, 1977. 9 refs, 1 graph.

Descriptors: \*Crop yield, \*Forecasting, Meteorological data, Agriculture, Rainfall, Temperature, Time, Linear regression, Statistical analysis, Data analysis, \*Corn(Field), \*Orange Free State, South Africa.

Reports on research aimed at forecasting a current year's maize crop using simple meteorological and other data. Compared with predictive methods developed elsewhere, the approach appears to hold particular promise as an agricultural micro-scale studies, where daily values of various meteorological parameters are used as a basis for prediction. Unfortunately the results obtained often lack practical application on a large scale even though they may be useful in other respects, for example, in providing a better understanding of the optimum conditions for promoting plant growth. (So Afr Water Info Ctr)  
W78-12471

**STORAGE-GAGE PRECIPITATION DATA FOR WESTERN UNITED STATES 1974-1975. VOLUME 20.**  
National Climatic Center, Asheville, NC.  
For primary bibliographic entry see Field 7C.  
W78-12623

**A CASE STUDY OF THE MEASUREMENT OF SNOWFALL BY RADAR: AN ASSESSMENT OF ACCURACY,**  
British Meteorological Office, Bracknell (England).  
For primary bibliographic entry see Field 2C.  
W78-12644

**OBSERVATIONS OF PRECIPITATION-FORCED CIRCULATIONS IN WINTER OROGRAPHIC STORMS,**  
Utah Water Research Lab., Logan.  
G. E. Hill.  
Journal of the Atmospheric Sciences, Vol. 35, No. 8, p 1463-1472, August 1978. 11 fig, 1 tab, 18 ref.

Descriptors: \*Air circulation, \*Precipitation(Atmospheric), \*Orography, \*Storms, \*Utah, Winter, Snow, Circulation, Mountains, Model studies, Mathematical models, On-site investigations, On-site data collections, Weather, Meteorology, Cloud physics, Precipitation-forced circulation.

Observational evidence was presented which identifies the occurrence of strong precipitation-forced circulations during winter orographic storms. It was shown by analysis of several case studies that precipitation in the mountains is greatly reduced following the development of such circulations. The development of a precipitation-forced circulation occurs first at low levels and expands upward to near mountain-top levels. Both the original updraft and the downdraft beneath are subsequently weakened; at that time there is a rapid reduction of precipitation. In most instances, a weak low-level updraft and a secondary maximum of precipitation redevelopment. (Sims-ISWS)  
W78-12648

**DROUGHT IN CALIFORNIA--WATER-RESOURCES DATA FOR 1977,**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-12730

**SUMMARY OF METROMEX, VOLUME 2: CAUSES OF PRECIPITATION ANOMALIES,**  
Illinois State Water Survey, Urbana.  
B. Ackerman, S. A. Changnon, Jr., G. Dzurisin, D. L. Gatz, and R. C. Grosh.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 288, Price codes: A18 in paper copy, A01 in microfiche. Bulletin 63, 1978. 399 p, 178 fig, 82 tab, 272 ref. DOE EY-76-02-1199, NSF ENV73-07796.

Descriptors: \*Weather modification, \*Weather patterns, \*Climatology, \*On-site investigations, \*Illinois, \*Missouri, Weather data, Meteorological data, Data collections, Winds, Air temperature, Humidity, Rainfall, Storms, Rainfall disposition, Data processing, Analytical techniques, Instrumentation, Networks, Distribution patterns, Hail, Cities, Water quality, Air pollution, Radar, Cloud physics, Meteorology, \*METROMEX, \*St. Louis(MO), Precipitation anomalies, Weather anomalies, Inadvertent weather modification.

This was the last of two volumes presenting the major findings from the 1971-1975 METROMEX field operations at St. Louis. It presented climatological analyses of surface weather conditions, but the report primarily concerned those factors helping to describe the causes of the anomalies. Volume 1 covered spatial and temporal distributions of surface precipitation and severe storms, and impacts of urban-produced precipitation anomalies. Volume 2 described relevant surface weather conditions including temperature, moisture, and winds, all influenced by the urban area. Urban influences extended well into the boundary layer affecting aerosol distributions, winds, and the thermodynamic structure, and often reached cloud base levels. Studies of modification of cloud and rain processes showed urban-industrial influences on (1) initiation, local distribution, and characteristics of summer cumulus clouds; and (2) development of precipitation in clouds and the resulting surface rain entities. (See also W78-06738) (Sims-ISWS)  
W78-12830

**AN ATTEMPT TO DETECT THE EFFECTS OF A STEELWORKS ON PRECIPITATION AMOUNTS IN CENTRAL HUNGARY,**  
Illinois Univ., Urbana-Champaign. Dept. of Ecology, Ethology, and Evolution; and Illinois Univ., Urbana-Champaign. Inst. for Environmental Studies.  
For primary bibliographic entry see Field 5B.  
W78-12860

**RAINFALL FREQUENCIES FOR THE PERSIAN GULF COAST OF IRAN,**  
Dames and Moore, Denver, CO.  
U. Kuppus, J. M. Bleek, and S. H. Blair.

## Snow, Ice, and Frost—Group 2C

Hydrological Sciences Bulletin, Vol. 23, No. 1, p 119-129, March, 1978. 4 tab, 2 fig, 19 ref.

Descriptors: \*Rainfall disposition, \*Probable maximum precipitation, Depth-area-duration analysis, Nuclear powerplants, \*Iran, \*Persian Gulf.

The purpose was to develop the design basis flood elevations for a proposed nuclear power plant at Haliheh, on the Persian Gulf. The probable maximum precipitation and 2-to 100-year return period rainfall events were estimated using graphical relationships. The need for very conservative design criteria motivated studies directed towards estimating the physical upper limits to storm rainfall in this region. While the climate is arid and subtropical, with a mean annual rainfall of 226 mm, sudden heavy rains could cause flooding that must be considered in designing the nuclear power plant. (Russell-Arizona)  
W78-12945

## 2C. Snow, Ice, and Frost

## PHYSICAL MEASUREMENTS OF RIVER ICE

JAMS,  
Army Terrestrial Sciences Center, Hanover, NH.  
D. J. Calkins.  
Water Resources Research, Vol. 14, No. 4, p 693-695, August 1978. 3 fig, 2 tab, 5 ref.

Descriptors: \*Ice jams, \*Measurement, \*On-site investigations, Rivers, Ice, On-site data collections, Data processing, Cold regions, Freezing, \*Ice thickness.

River ice jam measurements always have been relatively difficult to obtain because of the uncertain stability of the floating ice mass. But recently two ice jams resolidified for about 3 weeks, allowing the ice thickness to be measured at several cross sections along their longitudinal profiles. The size distribution of surface ice floes in one of the jams also was evaluated from low-level aerial photography. The ice jams were found to be thickest at the downstream end, of the order of 4-5 times the thickness of the ice cover before breakup, and decreased almost linearly in thickness upstream. The largest surface ice floes measured in one ice jam ranged from 0.27 to 0.05 of the river's average width (approximately 45 m). The largest floes were at the downstream end, and floe size decreased progressively with distance upstream. (Sims-ISWS)  
W78-12148

## THE DEPENDENCE OF THE RESIDUAL GRAVITY ON HYDRAULIC CONSTANTS IN GLACIAL DEPOSITS

Rhode Island Univ., Kingston. Dept. of Geology.  
For primary bibliographic entry see Field 2F.  
W78-12156

## ENERGY EXCHANGE OVER YOUNG SEA ICE IN THE CENTRAL ARCTIC

Washington Univ., Seattle. Dept. of Atmospheric Sciences.  
G. A. Maykut.  
Journal of Geophysical Research, Vol. 83, No. C7, p 3646-3658, July 20, 1978. 17 fig, 5 tab, 42 ref.  
ONR N00014-76-C-0324.

Descriptors: \*Sea ice, \*Energy transfer, \*Heat transfer, \*Model studies, \*Arctic, Mathematical models, Cold regions, Ice, Snow, Radiation, Solar radiation, Atmosphere, Temperature, Air temperature, Water temperature, Variability, Seasonal, Ice thickness, Snow effects.

A simple model of heat transport through young sea ice was combined with climatological data on air temperatures and incoming radiation in the central Arctic to predict how each component of the surface heat balance is affected by changes in ice

thickness. Results indicated that during the cold months the net heat input to the atmosphere from ice in the 0- to 0.4-m range in between 1 and 2 orders of magnitude larger than that from perennial ice. Once the ice exceeds a meter in thickness, there is little change in any of the heat fluxes as the ice thickens. Although both the amount of absorbed radiation and the emitted longwave radiation depend on ice thickness it is the turbulent fluxes which undergo the largest changes. The rate of heat exchange over thin ice was shown to be extremely sensitive to snow depth and assumed boundary layer temperatures. It was concluded that with the present ice thickness distribution in the central Arctic, total heat input to the atmospheric boundary layer from regions of young ice is equal to or greater than that from regions of open water or thick ice. (Sims-ISWS)  
W78-12162

PECULIARITIES OF BIOLOGICAL PRODUCTIVITY OF WATERS NEAR BIRD'S BAZAARS IN THE NORTH OF NOVAYA ZEMIYA (SOBENNOSTI BIOLOGICHESKOI PRODUKTIVNOSTI VOD BLIZ PTICHIKA BAZAROV SEVERA NOVOI ZEMLI, LENINGRAD, 1972), Sovetskii Natsionalnyi Komitet po Provedeniyu Mezhdunarodnoi Biologicheskoi Programmy, Moscow (USSR).  
For primary bibliographic entry see Field 5C.  
W78-12184

BIBLIOGRAPHY OF CANADIAN GLACIOLOGY, 1975 - BIBLIOGRAPHY NO. 1, GLACIER INVENTORY NOTE NO. 10,  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
C. S. L. Ommanney.  
Report Series No. 59, 1978, in English and French, 117 p.

Descriptors: \*Bibliographies, \*Glaciology, \*Census, \*Snow, \*Ice, \*Glaciers, \*Icebergs, Instrumentation, Methodology, Frost action, Meteorology, Climatology, Geographical regions, Arctic Ocean, \*Canada, Atlantic Provinces, Maritime Provinces, Marine environments, British Columbia, Northwest Territories, Ontario, Prairie Provinces, Quebec, Yukon Territory, Author Index, Geographical Index.

The bibliography lists all snow and ice studies in Canada published or printed in 1975. References are given under the following major subject headings - general glaciology; glaciological instruments and methods; physics of ice; land ice, glaciers, ice shelves; icebergs, sea, river and lake ice; glacial geology; frost action on rocks and soil, frozen ground, permafrost; meteorological and climatological glaciology; snow. A geographical and an author index are also provided. (WATDOC)  
W78-12252

WATER PRESSURE IN RIPE SNOWPACKS,  
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.  
A. Wankiewicz.  
Water Resources Research, Vol. 14, No. 4, p 593-600, August 1978. 9 fig, 14 ref.

Descriptors: \*Snowpacks, \*Melting, \*Water pressure, On-site investigations, On-site data collections, Tensiometers, Snow, Permeability, Darcys law, Equations, Melt water, Percolation, Steady flow, Unsteady flow, Diurnal.

The water pressure regime of a quasi steadily melting homogeneous and isotropic snowpack was derived from Darcy's equation and from an experimental determination of the permeability-pressure relation for snow. The derivation demonstrated that at a given melt rate, (1) significant water pressure gradients are confined to the base of the snowpack and (2) the snow water pressure at higher levels is independent of depth and equal

to a characteristic value called the gravity flow pressure, which is a function of the melt rate and wetting history of the snow. Simple and inexpensive tensiometers were used to measure the water pressure variations in a deep snowpack. Diurnal pressure changes were found to be about 300 N/sq m in amplitude within the ripe snow. Layering resulted in a scattering of the water pressures along the vertical direction. Such simple tensiometer measurements can now be used with the above derivation to provide field measurements of the permeability of different types of snow. (Sims-ISWS)  
W78-12627

CHEMISTRY OF SNOW MELTWATER: CHANGES IN CONCENTRATION DURING MELTING,  
Norsk Institutt for Vannforskning, Blindern.  
For primary bibliographic entry see Field 2K.  
W78-12630

DIFFERENCES IN RADAR RETURN FROM ICE-COVERED NORTH SLOPE LAKES,  
Army Terrestrial Sciences Center, Hanover, NH.  
W. F. Weeks, A. G. Fountain, M. L. Bryan, and C. Elachi.  
Journal of Geophysical Research, Vol. 83, No. C8, p 4069-4073, August 20, 1978. 5 fig, 7 ref. NASA NA57-100.

Descriptors: \*Lakes, \*Ice cover, \*Radar, \*Cold regions, \*Alaska, Remote sensing, Aircraft, Interfaces, Ice-water interfaces, Bubbles, Lake ice, Iced lakes, Salinity, Ice, Snow, On-site data collections, Radar backscatter.

Comparisons were made between L and X band synthetic aperture radar images of frozen lakes on the North Slope of Alaska and ground truth observations of the nature of their ice covers. It was shown that the differences in radar backscatter observed on different areas of a lake can be correlated with whether or not the lake is frozen completely to the bottom at the site in question. This explanation is reasonable inasmuch as the reflection coefficient associated with the high-dielectric contrast ice/water interface is significantly higher than that associated with a low-contrast ice/soil interface. However, the presence of the ice/water interface cannot be the only condition required for the higher backscatter because the ice/water interface per se would be specular at X and L band frequencies, causing the energy returned from the interface to be reflected away from the radar receiver. The other principal factor contributing to the return of energy from the ice/water interface to the receiver is believed to be the presence in the ice of numerous vertically elongated air bubbles which would act as scatterers. (Sims-ISWS)  
W78-12639

ICE GROWTH IN DULUTH-SUPERIOR HARBOR,  
Minnesota Univ., Duluth. Dept. of Physics.  
M. Sydor.  
Journal of Geophysical Research, Vol. 83, No. C8, p 4074-4078, August 20, 1978. 9 fig, 7 ref. NOAA USDC-NOAA-04-5-022-13.

Descriptors: \*Ice, \*Harbors, \*Heat budget, \*Lake Superior, Weather, Temperature, Radiation, Solar radiation, Air temperature, Water temperature, Snow, Computers, Lakes, Heat transfer, On-site investigations, \*Duluth(Minn), Ice thickness, LANDSAT, Ice growth.

The heat budget for ice in the Duluth-Superior Harbor was obtained from measurements of temperatures and net radiation and from weather data. It was found that ice growth in the harbor is nearly uniform and depends mainly on the net radiation term. Some localized variations in ice thickness can be attributed to the spatial distribution in al-



## Field 2—WATER CYCLE

### Group 2C—Snow, Ice, and Frost

bedo and the variation of the turbulent heat flux in water. For localized areas with high turbulence and thermal pollution where the heat transport in a water becomes significant, a 20-50% decrease in ice thickness is observed, depending on flow velocities and the proximity of the areas to the heated effluent sources. Outside of these localized areas there are smaller but persistent variations in ice thickness over broad regions of the harbor adjacent to the industrialized sections of Duluth and Superior. These variations can be attributed to the relative changes in the albedo due to particulate fallout. Landsat data were used for determination of the relative distribution in albedo, while the turbulent heat flux in water was obtained from temperature distribution measurements and from flow rates which were calculated from a numerical model of the harbor. (Sims-ISWS)  
W78-12640

**SHOALING OF WAVES UNDER ICE,**  
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.  
T. Green.  
Journal of the Waterway, Port, Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Technical Note, Vol. 104, No. WW4, p 327-330, August 1978. 4 fig, 3 ref, 1 append.

Descriptors: \*Ice cover, \*Shores, \*Waves(Water), \*Ice, Analytical techniques, Theoretical analysis, Breakup structures, Piles(Foundations), Ice breakup, Shoaling.

In winter, ice is often present along the shores of water bodies. The vertical motions of such ice can affect winter coastal dynamics and structures held up by offshore pilings. These motions are often due to waves generated offshore, in the ice-free area, and propagating shoreward. Then the shoaling of waves under a shorebound ice sheet is of some interest. The results also may provide insight to ice cracking and to variations in sediment motion and scouring under ice. Ice breaking is probably related to the maximum stress, and thus the maximum curvature of the ice sheet. In all cases calculated, the curvature increases monotonically with decreasing depth, more rapidly for thinner ice, so that the ice first reaches its ultimate strength at the shoreline. Presumably, the wave would completely reflect until this stress is reached. (Humphrey-ISWS)  
W78-12641

**A CASE STUDY OF THE MEASUREMENT OF SNOWFALL BY RADAR: AN ASSESSMENT OF ACCURACY,**  
British Meteorological Office, Bracknell (England).  
C. G. Collier, and P. R. Larke.  
Quarterly Journal of the Royal Meteorological Society, Vol. 104, No. 441, p 615-621, July 1978. 3 fig, 19 ref.

Descriptors: \*Remote sensing, \*Snowfall, \*Radar, Evaluation, Precipitation(Atmospheric), Measurement, Watersheds(Basins), Snow, Snowpacks, Surveys, Water resources, Rain gages, Runoff, Melt water, Weather, Meteorology.

Radar measurements during a period of snowfall in a region of variable terrain were described. The accuracy of estimates of areal snow depth, using a calibrated radar, was shown to be similar to that achieved for areal rainfall using the same technique. This detailed case study supported similar conclusions made by other workers, who used more cases but fewer validating measurements. It also was shown that provided the variations in terrain height are not very large, compensation for the effects of melting over low terrain can be made in deriving the snow depth field by using two independent snow depth calibration measurements—one representative of upland areas, and the other of lowland areas. (Sims-ISWS)  
W78-12644

**OBSERVATIONS OF PRECIPITATION-FORCED CIRCULATIONS IN WINTER OROGRAPHIC STORMS,**  
Utah Water Research Lab., Logan.  
For primary bibliographic entry see Field 2B.  
W78-12648

**BEHAVIOR OF THE BOUCHARD NO. 65 OIL SPILL IN THE ICE-COVERED WATERS OF BUZZARDS BAY,**  
For primary bibliographic entry see Field 5G.  
W78-12806

**POLAR CONTINENTAL SHELF PROJECT. TITLES AND ABSTRACTS OF SCIENTIFIC PAPERS SUPPORTED BY PCSP.**  
Department of Energy, Mines and Resources, Ottawa (Ontario) Polar Continental Shelf Project.  
For primary bibliographic entry see Field 5C.  
W78-12819

**TESTS OF THE ARCTIC BOAT CONFIGURATION OF THE LOCKHEED CLEAN SWEEP OIL RECOVERY SYSTEM IN A BROKEN ICE FIELD,**  
ARCTEC, Inc., Columbia, MD.  
For primary bibliographic entry see Field 5G.  
W78-12826

**MULTISPECTRAL REMOTE OBSERVATIONS OF HYDROLOGIC FEATURES ON THE NORTH SLOPE OF ALASKA,**  
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.  
D. K. Hall, and M. L. Bryan.  
Available from the National Technical Information Service, Springfield, VA 22161 as N77-27483, Price codes: A03 in paper copy, A01 in microfiche. Report NASA-TM-X-71351 (X-913-77-124), May 1977. 45 p, 18 fig, 6 tab, 43 ref.

Descriptors: \*Remote sensing, \*Lakes, \*Surface waters, \*Alaska, \*Arctic, Snow, Ice, Rivers, Snow cover, Aircraft, Satellites(Artificial), Instrumentation, Equipment, Data processing, Cold regions, \*North Slope(Alaska), LANDSAT.

Visible and near-infrared satellite data and active and passive microwave aircraft data were used to analyze some hydrologic features in Arctic Alaska. The following features were studied: the small thaw lakes on the Arctic Coastal Plain ('oriented lakes'), Chandalar Lake in the Brooks Range, several North Slope rivers, surface water on the tundra, and snowcover on the North Slope and in the Brooks Range. Passive microwave brightness temperatures (T sub B) as seen on Electrically Scanned Microwave Radiometer (ESMR) imagery were shown to increase with increasing ice thickness on all of the lakes studied. April Synthetic Aperture Radar (SAR) imagery of the oriented lakes revealed qualitative lake depth information. Lakes not frozen to the bottom (those more than 2 m in depth, because 2 m is the maximum ice thickness attained on these lakes) tend to give higher returns than lakes frozen to the bottom because of high reflections at the ice/water interface. Aueis, an important hydrologic parameter in the Arctic, was observable in the Sagavanirktok River channel on April ESMR imagery. The low resolution (approximately 500 m) of the ESMR imagery does not permit any quantitative analyses. However, Landsat imagery with better (80 m) resolution was useful for measuring aueis extent using band 5 imagery obtained just after snowmelt in June. It was shown that the extent of aueis (as measured on Landsat imagery) varies with meteorological conditions and, therefore, may be a useful indicator of annual climate fluctuations on the North Slope. (Sims-ISWS)  
W78-12832

**SUSPENDED SEDIMENT DYNAMICS IN BLUE FJORD, WESTERN PRINCE WILLIAM SOUND, ALASKA,**  
Alaska Univ., College. Inst. of Marine Science.  
For primary bibliographic entry see Field 2L.  
W78-12835

**THERMODYNAMIC EQUILIBRIUM BETWEEN ICE AND WATER IN POROUS MEDIA,**  
Norwegian Geotechnical Inst., Oslo (Norway).  
J. P. G. Loch.  
Soil Science, Vol 126, No 2, p 77-80, August 1978. 9 ref.

Descriptors: \*Thermodynamics, \*Ice, \*Water properties, \*Porous media, Model studies, Mathematical models, Equations, Equilibrium, Soils, Soil water, Freezing, Melting, Frozen soils, Soil science.

A derivation was given for the equation of thermodynamic equilibrium between ice and water in porous media. The equation accounts for a difference between the pressure of the ice phase and the total potential (in pressure units) of the water phase. Emphasis was laid on the distinction between the total potential and the hydrostatic pressure and osmotic pressure of the unfrozen soil solution. The difference between the hydrostatic pressure of the solution and the ice pressure was accounted for by the ice-water interfacial tension, as expressed by the generalized form of Laplace's equation. The resulting generalized form of the Clausius-Clapeyron equation is an equilibrium expression, whereas the Laplace equation only expresses a definition, valid under any circumstances. It was emphasized that all influences of the pore wall, which may or may not work via the diffuse double layer and which cause the liquid to have lower Gibbs free energy than the equilibrium liquid at the same temperature, were collected in the osmotic pressure term. (Sims-ISWS)  
W78-12841

**ICEBERGS MIGHT SUPPLY WATER TO ARID REGIONS,**  
Iowa State Univ., Ames.  
For primary bibliographic entry see Field 3B.  
W78-12936

## 2D. Evaporation and Transpiration

**TRANSPIRATION OBSERVATIONS FROM A SPRUCE FOREST AND COMPARISONS WITH PREDICTIONS FROM AN EVAPORATION MODEL,**  
Institute of Hydrology, Oxon (England).  
I. R. Calder.  
Journal of Hydrology, Vol. 38, No. 1/2, p 33-47, July 1978. 6 fig, 13 ref.

Descriptors: \*Transpiration, \*Forests, \*On-site investigations, \*Model studies, Precipitation(Atmospheric), Rainfall, Rain gages, Lysimeters, Evaporation, Evapotranspiration, Soil moisture, Watersheds(Basins), Forest watersheds, Trees, Nuclear moisture meters, Soil water, Spruce forests.

Neutron-probe and lysimetric techniques were used to investigate the transpiration response of spruce forest to changing environmental variables and to test the operation of a previously proposed model of evaporation. Measurements obtained during the summer drought in 1976 enabled the influence of soil-moisture and vapor-pressure deficits to be determined over an exceptional range. The experimental results were consistent with model predictions. Model predictions also were shown to be consistent with independent 'tree cutting' experiments. (Sims-ISWS)  
W78-12149

## Streamflow and Runoff—Group 2E

**EVAPOTRANSPIRATION FROM WATER HYACINTH IN TEXAS RESERVOIRS,** Texas A and M Univ., College Station. Dept. of Civil Engineering. A. R. Benton, Jr., W. P. James, and J. W. Rouse, Jr. Water Resources Bulletin, Vol. 14, No. 4, p 919-930, August 1978. 3 fig, 3 tab, 21 ref. NASA NGL44-001-001.

Descriptors: \*Evapotranspiration, \*Water hyacinth, \*Reservoirs, \*Water loss, \*Texas, Aquatic plants, Floating plants, Aquatic life, Aquatic weeds, Lakes, Water resources, Planning, Vegetation, Vegetation effects, \*Texas Water Plan, Aquatic plant control.

Water hyacinth, an attractive, floating aquatic plant, poses a substantial threat of unanticipated water loss from Texas reservoirs. A mature plant will lose about three times as much water through evapotranspiration as is lost from evaporation of an equivalent area of open water. The reservoirs of east and southeast Texas, which comprise the bulk of the state's existing and planned water storage capacity, seem likely to suffer a 20% average surface infestation of water hyacinth. A coverage that great will result in a yearly net loss of over 2,000,000 acre-feet of impounded water, based on present water development plans for the state. This would amount to nearly 20% of the anticipated yield from the reservoirs affected. An effective aquatic plant control program could head off the threat of this significant water loss. (Sims-ISWS) W78-12155

**FEASIBILITY STUDY OF GENERAL CRUST MANAGEMENT AS A TECHNIQUE FOR INCREASING CAPACITY OF DREDGED MATERIAL CONTAINMENT AREAS,** Texas A and M Research Foundation, College Station. For primary bibliographic entry see Field 8D. W78-12622

**ICE GROWTH IN DULUTH-SUPERIOR HARBOR,** Minnesota Univ., Duluth. Dept. of Physics. For primary bibliographic entry see Field 2C. W78-12640

**ESTIMATING EVAPOTRANSPIRATION FROM POTENTIAL EVAPORATION: PRACTICALITY OF AN ICONOCLASTIC APPROACH,** Department of the Environment, Ottawa (Ontario). Hydrology Research Div. F. I. Morton. Journal of Hydrology, Vol. 38, No. 1/2, p 1-32, July 1978. 10 fig, 1 tab, 22 ref.

Descriptors: \*Evapotranspiration, \*Evaporation, \*Model studies, \*Canada, \*Africa, Mathematical models, Evaporation pans, Solar radiation, Temperature, Air temperature, Humidity, Albedo, Meteorological data, Climatology, Meteorology, \*Ireland, \*Kenya, Potential evaporation.

The concept of a complementary relationship between the evapotranspiration from an area and the potential evaporation at some point in the area is diametrically opposed to the conventional wisdom. However, pan and dish evaporation data from irrigated areas and adjoining deserts provide evidence that the above mentioned concept reflects reality. Furthermore, the mentioned concept provides the basis for a model that permits evapotranspiration to be estimated from the routine observations of temperature, humidity, and sunshine duration that are used in computing potential evaporation, thereby eliminating the need to represent the complexities of the soil-vegetation system by locally optimized fudge factors. This means that the model is verifiable so that errors in the associated assumptions and empirical

relationships can be detected and corrected over an ever-widening range of environments. The current model represents the culmination of such a methodology. It was calibrated at climatological stations in desert areas where the monthly precipitation approximates evapotranspiration and applied over a wide range of environments without local optimization of coefficients. The practicality of this unorthodox approach was demonstrated by comparing model estimates of evapotranspiration with the corresponding water budget estimates for 122 river basins in Canada, Ireland, Kenya, and the southern U.S. (Sims-ISWS) W78-12646

**EVAPORATION CONTROL ON FARM-SIZE RESERVOIRS,** Department of Agriculture, Saskatoon (Saskatchewan). Research Station. For primary bibliographic entry see Field 3B. W78-12649

**REDUCING PHREATOPHYTE TRANSPIRATION,** California Univ., Davis. Dept. of Land, Air and Water Resources. For primary bibliographic entry see Field 3B. W78-12939

**DIURNAL TRENDS IN WATER STATUS, TRANSPIRATION, AND PHOTOSYNTHESIS OF SALT CEDAR,** Idaho State Univ., Pocatello. Dept. of Biology. For primary bibliographic entry see Field 3B. W78-12940

**CONSTANCY OF THE CORRELATION BETWEEN TRANSPIRATION RATES AND NEEDLE MASS IN THE SCOTCH PINE (IN RUSSIAN),** Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Vinodeliya i Vinogradarstva, Yalta (USSR). V. E. Rudakov. Fiziol Rast (Moscow) 24(4), p 854-855, 1977.

Descriptors: \*Scotch pines, \*Transpiration rates, \*Literature review, Needle mass, \*Moisture deficit, Age(Trees).

A literature review on the relationship between transpiration rates and needle mass curves in relation to age is presented. The relationship of moisture loss to needle mass established. The relationship between the transpiration rate over a vegetative period and the mass of pine needles was not age-related and thus remained constant between new stands of pine and older trees. Copyright 1978, Biological Abstracts, Inc. W78-12944

**APPLICATION OF AN EVAPORATIVE LOSS MODEL TO ESTIMATE THE PERSISTENCE OF CONTAMINANTS IN LENTIC ENVIRONMENTS,** Purdue Univ., LaFayette, IN. Dept. of Forestry and Natural Resources. For primary bibliographic entry see Field 5B. W78-12982

## 2E. Streamflow and Runoff

**KALMAN FILTER IN OPEN CHANNEL FLOW ESTIMATION,** Pittsburgh Univ., PA. Dept. of Civil Engineering. For primary bibliographic entry see Field 8B. W78-12137

**GENERATION OF SKEWED ANNUAL FLOWS USING FAST FRACTIONAL GAUSSIAN NOISE GENERATOR,** Monash Univ., Clayton (Australia). Dept. of Civil Engineering. R. Srikanthan, and T. A. McMahon. Water Resources Research, Vol. 14, No. 4, p 665-671, August 1978. 2 fig, 4 tab, 12 ref, 1 append.

Descriptors: \*Synthetic hydrology, \*Streamflow, \*Model studies, \*Mathematical models, Flow, Markov processes, Mathematics, Streams, Rivers, Hydrology, \*Australia, Gaussian noise generator.

The fast fractional Gaussian noise process was modified to generate skewed streamflows and those having negative lag 1 autocorrelation. The modified procedures were applied to two Australian streams, and the results were compared with the corresponding historical values. (Sims-ISWS) W78-12146

**SERIALLY LINKED RESERVOIR SYSTEM DESIGN USING STOCHASTIC PROGRAMMING,** Magyar Tudomanyos Akademia, Budapest. For primary bibliographic entry see Field 4A. W78-12147

**EXPECTED VALUE OF ASYMPTOTIC MAXIMUM DEFICIT FOR PERIODIC-STOCHASTIC INFLOWS OF FULL-FLOW REGULATION,** Engineering Consultants, Inc., Denver, CO. For primary bibliographic entry see Field 4A. W78-12150

**GENERATING STREAMFLOW SEQUENCES WITH TREND AND CYCLICAL MOVEMENTS,** Florida Univ., Belle Glade. Dept. of Agricultural Engineering. S-F. Shih. Water Resources Bulletin, Vol. 14, No. 4, p 942-955, August 1978. 5 fig, 4 tab, 11 ref.

Descriptors: \*Streamflow, \*Model studies, \*Synthetic hydrology, \*Florida, Mathematical models, Computer models, Computer programs, Regression analysis, Analytical techniques, Hydrology, \*Kissimmee River(Fla), Autoregressive models, Trend movement, Cyclical movement.

A first-order autoregressive model was modified with the trend and cyclical movements to generate the streamflow sequences. Three main portions were involved in this modified model, i.e., six-year cycle with trend changing; six-year cycle without trend changing; and both annual and six-year cycles with trend changing. The synthetic sequences of monthly streamflow sequences were compared with the historical records obtained from the Kissimmee River basin by using the Chi-Square test for goodness-of-fit. The results indicated that the newly proposed model has a better solution than the original model because the trend and cyclical movements involved in generating sequences are much closer to the historical records. (Sims-ISWS) W78-12157

**STREAMFLOW REGIONALIZATION IN BRITISH COLUMBIA, NO. 4 REGRESSION OF LOW FLOWS ON PHYSIOGRAPHIC PARAMETERS,** Department of the Environment, Vancouver (British Columbia). Inland waters Directorate (Pacific Region). R. M. Leith. Report Series No. 57, 1978, 26 p, 4 fig, 3 ref, 2 tab, 4 append.

Descriptors: \*Streamflow, \*Low flow, \*Regional analysis, \*Average, \*Annual, Flow, Statistics, Precipitation(Atmospheric), Sampling, Hydrometry, Drainage area, Geomorphology,

## Field 2—WATER CYCLE

### Group 2E—Streamflow and Runoff

Parametric hydrology, Calibration, Canada, \*British Columbia, \*Vancouver Island.

Mean annual seven-day low flows have been regressed on basin-averaged physiographic parameters for 85 hydrometric stations in British Columbia. To examine the effect of number of stations used in the analysis several sets of random samples were selected from the 85 stations and equations developed for each sample. Finally, for the complete 85-station sample, the following equation was developed for unit mean low flow (UMLF), in cfs per square mile: UMLF equals  $0.6689 \text{ plus } 0.0130 \text{ NPOSI minus } 0.0001170 \text{ ELEV plus } 0.005350 \text{ SLP percent minus } 0.0007083 \text{ DSN minus } 0.0008782 \text{ DSNW plus } 0.02073 \text{ RALKE minus } 0.00009903 \text{ BHW plus } 0.00008956 \text{ SENW plus } 0.00001215 \text{ SEW minus } 0.00003755 \text{ SESW}$ . This equation explained 65 percent of the variance and had a standard error of estimate of 0.204 or 52 percent percent of the response mean. Examination of the residuals for the preceding equation provided evidence for the geographical division of the original sample into three regions. Equations were developed for each region. The regionalization procedure was tested by a split sample which indicated that better estimates were made with the regional equations than with the overall equation. (WATDOC)  
W78-12257

**STOCHASTIC MODELING OF WATERSHED SYSTEMS,**  
Illinois Univ. at Urbana-Champaign.  
For primary bibliographic entry see Field 2A.  
W78-12264

**RIVER RUNOFF AND THE YIELD OF DAMS IN RHODESIA,**  
For primary bibliographic entry see Field 4A.  
W78-12475

**RIVER MANAGEMENT,**  
R. M. Wild.  
Rhodesia Science News, (Salisbury), Vol 11, No 6, p 127-132, 1977. 3 fig, 1 map.

Descriptors: \*Water resources, \*Management, Rivers, \*Future planning, Water demand, Dam construction, Financing, Design standards, Droughts, Water costs, \*Rhodesia, Africa.

The purpose of river management is to ensure the optimum development and use of our water resources. It presents the basic problem of industry, business and economics: how to make the best use of the scarce resources available, operating within constraints such as limitations of data, authority, the law, finance, staff and supply. It is the function of management to identify the constraints and where possible, to work for their removal but otherwise to work as efficiently as possible within them. (So Afr Water Info Ctr)  
W78-12476

**RELIABILITY OF FLOOD WARNING,**  
Illinois Univ. at Urbana-Champaign. Dept. of Civil and Ceramic Engineering.  
For primary bibliographic entry see Field 6F.  
W78-12528

**APPLICATION OF STOCHASTIC MODELS TO RESERVOIRS NEAR THE ALPS,**  
Technische Univ., Munich (West Germany). Inst. for Hydraulics and Hydrology.  
For primary bibliographic entry see Field 4A.  
W78-12529

**AN ADAPTIVE ALGORITHM FOR ANALYZING SHORT-TERM STRUCTURAL AND PARAMETER CHANGES IN HYDROLOGIC PREDICTION MODELS,**  
Princeton Univ., NJ. Dept. of Civil Engineering.

For primary bibliographic entry see Field 2A.  
W78-12551

**EVALUATION OF DETENTION BASINS FOR CONTROLLING URBAN RUNOFF AND SEDIMENTATION,**  
Kentucky Water Resources Research Inst., Lexington.  
For primary bibliographic entry see Field 2A.  
W78-12608

**APPROXIMATION OF A NORMAL DISTRIBUTION BY A THREE-PARAMETER LOG-NORMAL DISTRIBUTION,**  
Washington Univ., Seattle. Dept. of Civil Engineering.  
S. J. Burges, and K. Hoshi.  
Water Resources Research, Vol 14, No 4, p 620-622, August 1978. 1 fig, 3 tab, 4 ref, 1 append.

Descriptors: \*Analytical techniques, \*Data processing, \*Hydrology, \*Streamflow, Equations, Formulation, Mathematical models, Mathematics, Normal distributions, Log normal distributions.

A procedure was given where mixed normal and log normal populations exist; the normal populations can be approximated with three-parameter log normal (3PLN) distributions to facilitate multivariate stochastic hydrologic disaggregation or generation approaches. Approximations can be made by assuming an arbitrary small value of skew  $G(0.05-0.01)$ . For  $G$  less than or equal to 0.1, the appropriate parameters for a 3PLN distribution can be approximated as dimensionless location parameter. Equations for the parameters were given. (Sims-ISWS)  
W78-12631

**HOLOCENE STRATIGRAPHY IN FLOOD FREQUENCY ANALYSIS,**  
Denver Univ., CO. Dept. of Geography.  
J. E. Costa.  
Water Resources Research, Vol 14, No 4, p 626-632, August 1978. 6 fig, 37 ref. USGS 14-08-0001-G-517.

Descriptors: \*Flood frequency, \*Stratigraphy, \*United States, \*Radioactive dating, Erosion, Trees, Analytical techniques, Floods, Disasters, Frequency, Data processing, Geology, Organic matter, Soil properties, Floodplains, \*Holocene stratigraphy.

The risk of rare catastrophic flood events is extremely difficult to evaluate by using conventional flood frequency analyses. The true return period may be so long compared to gaging station or historical records that the stratigraphic record of the Holocene (0-10,000 years B.P.) may be the best method for assessing the risk of outstanding floods. Several geologic methods applicable to flood frequency analysis are: (1) tree ring analysis of floodplain trees destroyed or scarred by floodwaters, (2) radiocarbon dating of organics in deposits (landforms) eroded by recent floods, (3) radiocarbon dating or organic materials in older flood deposits, (4) pollen analysis and radiocarbon data of organic materials in lenses of fine-grained alluvium buried by coarse flood deposits, (5) radiocarbon dating of soil horizons or organic material in slack-water deposits, (6) radiocarbon or archaeological dating of soils developed in older flood deposits, and (7) dating of landforms eroded or buried by floods based on changes in quantitative soil properties versus time. Using one or more of the above geologic techniques, return periods of some recent catastrophic floods in the United States are: 1976 Big Thompson River, Colorado, 5000 years; 1964 Klamath River, California, 100 years; 1972 Western Run, Maryland, 2100 years; and 1972 Elm Creek, Texas, 400 years. (Sims-ISWS)  
W78-12632

**FLOOD-FREQUENCY ANALYSES WITH PRERECORD INFORMATION,**  
Geological Survey, Reston, VA. Water Resources Div.  
For primary bibliographic entry see Field 4A.  
W78-12729

**FRICTION COEFFICIENT VARIATION WITH FLOW IN AN URBAN STREAM,**  
Severn-Trent Water Authority, Birmingham (England).  
For primary bibliographic entry see Field 8B.  
W78-12863

**STATISTICAL MODELS AND METHODS FOR RIVERS IN THE SOUTHWEST,**  
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.  
S. Yakowitz.  
Hydrology and Water Resources in Arizona and the Southwest, Vol. 7, p 147-151, 1977. 1 fig, 15 ref.

Descriptors: \*Statistical models, \*Model studies, \*Simulation analysis, Computer models, Hydrologic data, River flow, River forecasting, Streamflow forecasting, Southwest U.S.

Essential in decision making relating to irrigation planning, reservoir control, flood forecasting structural design for flood retention is the ability to create statistical models of riverflow. This author believes that presently used models are unsatisfactory principally because derived simulations bear little resemblance to southwestern river records. Presented in this paper is a general Markov model which assumes only that rivers have a finite memory. Procedures for calibration are illustrated and evidence is presented for the success of this method is simulating typical flows. (Tickeys-Arizona)  
W78-12925

### 2F. Groundwater

**CARBON CONTENTS AND SOURCES IN GROUND WATERS OF THE CENTRAL PLATTE REGION IN NEBRASKA,**  
Nebraska Univ., Lincoln. Conservation and Survey Div.  
For primary bibliographic entry see Field 5A.  
W78-12103

**MAPPING OF EARTH FISSIONS IN LAS VEGAS VALLEY, NEVADA,**  
Nevada Univ. System, Reno. Water Resources Center.  
R. O. Patt, and G. B. Maxey.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 969, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, Publication No. 41501, March 1978. 19 p, 8 fig, 11 ref. A-071-NEV(1).

Descriptors: Fissuring, Subsidence, Groundwater effects, \*Nevada, \*Mapping, \*Las Vegas Valley (Nev).

In 1948 Maxey and Jameson theorized that certain scarp features in the Las Vegas Valley may be related to differential compaction of alluvium. Earth fissures have been observed for at least 20 years near some of these fault scarps, as well as associated with several high yield wells. Seven zones of fissuring in the vicinity of Las Vegas are outlined and discussed. Fissures in Las Vegas Valley can be correlated with the following features: (1) fault scarps (compaction or tectonic); (2) well fields; and (3) tectonic activity. Several features are noted which may be interrelated with subsidence and fissuring in Las Vegas Valley. Damage to streets and homes as a result of fissuring is discussed.  
W78-12107



## WATER CYCLE—Field 2

### Groundwater—Group 2F

#### WISCONSIN GROUND WATER - AN ANNOTATED BIBLIOGRAPHY, 1973-1977.

Wisconsin Univ., Madison. Water Resources Center.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 520. Price codes: A05 in paper copy, A01 in microfiche. Bibliography, Report WIS-WRC 78-06, 86 p. Compiled by A. Zaporozec. OWRT A-081-WIS(2), 14-34-0001-7106.

Descriptors: \*Groundwater, \*Bibliographies, Information exchange, Publications, Abstracts, \*Wisconsin.

First annotated supplement to the Bibliography of Wisconsin Groundwater 1834-1972, includes 254 citations to publications on various aspects of Wisconsin's groundwater resource which were published during the years 1973 through 1977. The number of entries is indicative of the continuing interest and concern in the field of groundwater in Wisconsin and documents the need for regular bibliographical control. The references were annotated from the following source materials: reports in professional and trade magazines and journals; reports, studies and unpublished material in federal, state and local files; books, documents, and conference proceedings; and student theses in the University of Wisconsin libraries. The references are arranged by author for each calendar year, and accompanied by author, county, general reference indexes. An abbreviation in the upper right corner of each entry indicates the library where the reference is located. (See also W78-12600)  
W78-12135

#### A STUDY OF THE KALAMOS SPRINGS IN GREECE WITH ENVIRONMENTAL ISOTOPES,

International Atomic Energy Agency, Vienna (Austria).  
B. R. Payne, J. Leontiadis, Ch. Dimitroulas, A. Dounas, and G. Kallergis.  
Water Resources Research, Vol. 14, No. 4, p 653-658, August 1978. 4 fig, 1 tab, 4 ref.

Descriptors: \*Springs, \*Recharge, \*Isotope studies, Geology, Groundwater, Stable isotopes, Sampling, Chemical analysis, Data processing, Mixing, Groundwater movement, Coasts, Water chemistry, \*Greece.

Variations in the stable isotopic composition of water were used to define the area of recharge to the Kalamos springs, issuing brackish water near the coast. The two possible areas of recharge differed in elevation, so that their stable isotope indices were different owing to the altitude effect, whereby the stable isotopic composition of precipitation contains less deuterium and 180 with an increase of elevation. The results of the study showed that the area of recharge is located in the Farnis system at elevations greater than 570 m. (Sims-ISWS)  
W78-12144

#### A STUDY OF UNCONFINED NON-DARCY SEEPAGE TO A WELL,

Indian Inst. of Tech., Kharagpur (India). Dept. of Civil Engineering.  
B. S. Rama Rao, and R. N. Das.  
Journal of Hydrology, Vol. 38, No. 1/2, p 161-178, July 1978. 5 fig, 5 tab, 20 ref.

Descriptors: \*Seepage, \*Wells, \*Water wells, \*Model studies, Mathematical models, Hydraulic conductivity, Free surfaces, Groundwater, Groundwater movement, Porous media, Darcys law, Water levels, Water table, Flow, Hydrology, Non-Darcy seepage.

A study was made, by the finite-element method, of a few specific cases of the problem of steady non-Darcy seepage to a fully penetrating well in an

unconfined aquifer based on Forchheimer's non-linear seepage law. Two types of problems were considered: in one type the entire seepage domain around the well was assumed to experience non-Darcy flow; and in the other type, the seepage domain close to the well was assumed to have non-Darcy flow, with the rest of the domain having Darcy flow. A qualitative appraisal was made of the difference between Darcy and non-Darcy flow conditions in relation to the discharge into the well, the form of the free surface, the potential and the potential gradients in the flow domain. (Sims-ISWS)  
W78-12151

#### NUMERICAL SOLUTION OF UNSTEADY FLOW PROBLEMS IN POROUS MEDIA BY SPLINE FUNCTIONS,

Technical Univ. of Istanbul (Turkey). Dept. of Petroleum Engineering.  
A. H. Dogru, W. Alexander, and R. L. Panton.  
Journal of Hydrology, Vol. 38, No. 1/2, p 179-195, July 1978. 6 fig, 2 tab, 19 ref.

Descriptors: \*Unsteady flow, \*Porous media, \*Model studies, Mathematical models, Mathematics, Equations, Aquifers, Groundwater movement, Flow, Analytical techniques, Hydrology, \*Spline functions.

Two dimensional spline functions were utilized in the solution of linear parabolic partial differential equations which describe the transient flow of water in porous aquifers with and without a sink within the domain. A collocation method of solution was used, and several types of spline representations were investigated. Results were compared with the finite-difference solutions and with the analytical solutions. B-splines with an extended region of definition were concluded to be superior. For problems with a sink, the B-splines alone were not accurate; however, supplementing the splines with a logarithm term produced very good results. (Sims-ISWS)  
W78-12152

#### THE DEPENDENCE OF THE RESIDUAL GRAVITY ON HYDRAULIC CONSTANTS IN GLACIAL DEPOSITS,

Rhode Island Univ., Kingston. Dept. of Geology.  
R. K. Frohlich.  
Water Resources Bulletin, Vol. 14, No. 4, p 931-941, August 1978. 8 fig, 2 tab, 8 ref. NSF HE575-12253.

Descriptors: \*Glacial aquifers, \*Gravity studies, \*Groundwater, \*Rhode Island, On-site investigations, Glacial drift, Glacial sediments, Aquifers, Hydraulic conductivity, Profiles, Underground streams, Transmissivity, Bedrock, Wells, Water resources, Residual gravity.

Buried glacial stream channels contain large and easily accessible groundwater resources. Gravity surveys have been applied frequently for their location. A gravity survey in the geohydrologically explored Wood River Valley Area of southern Rhode Island showed extreme lows of -2 mgals over channel depths of maximal 300 feet. Three gravity profiles were observed in east-west direction across a north-south striking stream channel. The bedrock depth increases rapidly towards the south from 130 to 300 feet. The gravity lows observed across each profile are not related to the bedrock depth but rather to the saturated thickness of the main aquifer and its hydraulic transmissivity. Well logs indicated that the large change of bedrock depth is solely due to an increase of till of low permeability. The volume of the glacial outwash, which is the major groundwater resource, changed little underneath the three profiles. The gravity lows appear to be related directly to the density contrast between glacial outwash and till. The response to the hydraulically more pertinent units renews the interest in the gravity method as it may have a potential to

estimate yields of hydrologically complex aquifers. (Sims-ISWS)  
W78-12156

#### FRESNO, CALIF., SUBSURFACE DRAIN COLLECTOR-DEEP WELL RECHARGE SYSTEM,

Agricultural Research Service, Fresno, CA. Water Management Research.  
For primary bibliographic entry see Field 4B.  
W78-12158

#### COMPREHENSIVE ANALYSIS OF WATER-TABLE AQUIFER TEST DATA,

Upper Mississippi River Basin Commission, Twin Cities, MN. Minnesota.  
For primary bibliographic entry see Field 4B.  
W78-12165

#### ON THE STATE OF SATURATION OF GROUNDWATER WITH RESPECT TO DISSOLVED CARBONATES, EDWARDS ARTESIAN AQUIFER, SOUTH-CENTRAL TEXAS,

San Diego State Univ., CA. Dept. of Geological Sciences.  
For primary bibliographic entry see Field 2K.  
W78-12216

#### EFFECT OF BALCONES FAULTS ON GROUNDWATER MOVEMENT, SOUTH CENTRAL TEXAS,

San Diego State Univ., CA. Dept. of Geological Sciences.  
F. L. Abbott.  
The Texas Journal of Science, Vol. 29, Nos 1 and 2, p 5-14, Sept 1977. 3 fig, 13 ref.

Descriptors: \*Groundwater movement, \*Subsurface flow, Fractures(Geologic), \*Texas, \*Balcones fault(Tex), \*Faults(Geologic).

According to evidence presented in this paper, the fault surfaces in the Balcones system are not the major sites of cavern development characteristic of south central Texas. Various fault-defined blocks have had different degrees of cavern formation. The larger faults in Comal County have acted as barriers diverting ground-water flow to the northeast. The location of most major fault systems was determined largely by the porosity and permeability, in addition to structural controls incident to Balcones faulting, created by groundwater flow patterns established millions of years ago. Modern cave locations are thus inherited and may demonstrate no easily discernible relationship to modern topography and stream courses. (Russell-Arizona)  
W78-12219

#### COMPUTER ESTIMATES OF NATURAL RECHARGE THROUGH SOILS IN SOUTHERN ARIZONA, U.S.A.,

Geological Survey of Israel, Jerusalem; and Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.  
U. Kafri, and J. Ben Asher.  
Journal of Hydrology, Vol. 38, p 125-138, July, 1978. 6 fig, 2 tab, 8 ref.

Descriptors: \*Natural recharge, \*Soil water movement, \*Hydrologic budget, Computer models, Mathematical models, Arizona.

Rainfall in the Sonoita and Cienega Basins in Arizona is characterized by intense thunderstorms of 30 to 60 minutes in the summer and rainy days (averaging 2) in the winter. This may explain why conventional water balance methods employing long-term average values of rainfall, runoff and evapotranspiration yield values of natural recharge which have little correlation with rainfall for these basins. A different approach for calculating recharge through soils is proposed, based on the basins' characteristics and rainfall regimes.

## Field 2—WATER CYCLE

### Group 2F—Groundwater

This model deals with individual rainfall events, considering moisture distribution, evapotranspiration and deep drainage as initial and boundary conditions. The results show that while winter rainfall is smaller than summer rainfall, its computed contribution to recharge through soils is considerably higher. Various factors affecting recharge are also discussed. (Russell-Arizona)  
W78-12232

**USE OF HYDROCHEMICAL TECHNIQUES IN GROUNDWATER EXPLORATION IN THE VENTERSTAD AREA, CAPE PROVINCE (IN AFRIKAANS),**  
P. J. Van der Linde, and F. D. I. Hodgson.  
Water SA (Pretoria) Vol 3, No 3, p 166-171, 1977, 9 ref, 4 fig, 1 tab.

**Descriptors:** \*Hydrochemistry, \*Groundwater sources, Water resources evaluation, Chemical analysis, Groundwater recharge, Carbon radioisotopes, Tritium, Aquifers, Sulfate, Hydrogeochemistry, Groundwater flow, \*Cape Province, \*South Africa.

The object of this research is to demonstrate the extent to which hydrochemical techniques can be used in preliminary groundwater resource evaluations. A theoretical background of the techniques applied is presented and the validity of the method is tested against actual field data from the Venterstad area. From chemical analyses it is concluded that the groundwater can be grouped into two categories, namely recently recharged groundwater and old groundwater. These conclusions are verified by a comparison of the results with actual <sup>14</sup>C and tritium age determinations on some of the samples. The old groundwater can undoubtedly be connected with a deep-seated aquifer, which in turn could have been responsible for the flooding of the nearby Orange-Fish River Tunnel in 1969. A prominent feature of some of these old groundwaters, is a low concentration of sulfate, which can be ascribed to bacterial action. The consistency of the groundwater chemistry, with regard to time, is also demonstrated. It is suggested that future groundwater development projects in the Southern Orange Free State should be limited to the older, more consistent source. (So Afr Water Info Ctr)  
W78-12465

**RESTORATION OF THE DOLOMITE WATER BALANCE AT WESTERN AREAS GOLD MINING COMPANY LTD,**  
For primary bibliographic entry see Field 4B.  
W78-12488

**BIBLIOGRAPHY AND INDEX OF WISCONSIN GROUNDWATER, 1851-1972: ADDENDUM 1834-1972.**  
Wisconsin Univ.-Madison. Water Resources Center.  
For primary bibliographic entry see Field 10C.  
W78-12600

**GROUND WATER IN THE CALIFORNIA WATER QUANDRY,**  
Environmental Defense Fund, Washington, DC.  
For primary bibliographic entry see Field 4B.  
W78-12615

**SPATIAL AND TEMPORAL HYDROCHEMICAL VARIATIONS IN A SEMICONFINED BURIED CHANNEL AQUIFER: ESTERHAZY, SASKATCHEWAN, CANADA,**  
Waterloo Univ. (Ontario). Dept. of Earth Sciences.  
For primary bibliographic entry see Field 2K.  
W78-12637

**ARTIFICIAL GROUND-WATER RECHARGE AS A WATER-MANAGEMENT TECHNIQUE ON THE SOUTHERN HIGH PLAINS OF TEXAS AND NEW MEXICO,**  
Geological Survey, Austin, TX. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W78-12725

**GROUND-WATER RESOURCES OF ADAMS AND BOWMAN COUNTIES, NORTH DAKOTA,**  
Geological Survey, Bismark, ND. Water Resources Div.  
M. G. Croft.  
North Dakota County Ground-Water Studies 22--Part III, and North Dakota Geological Survey Bulletin 65--Part III, 1978. 54 p, 18 fig, 4 plates, 7 tab, 51 ref.

**Descriptors:** \*Groundwater resources, \*Aquifer characteristics, \*Groundwater availability, \*Water quality, \*Hydrogeology, Water yield, Water levels, Water utilization, Potential water supply, \*North Dakota, Adams County, Bowman County.

The most important aquifer in Adams and Bowman Counties, N.Dak., is in the Fox Hills Formation and the basal part of the Hell Creek Formation. The aquifer system, which ranges in thickness from 340 to 520 feet, crops out in western Bowman County and is as much as 940 feet below land surface in Adams County. The beds consist of fine- to medium-grained sandstone interbedded with siltstone and claystone. The transmissivity ranges from 110 feet squared per day in western Bowman County to 540 feet squared per day in eastern Adams County. Bowman, Hettinger, Reeder, and Scranton pump about 570 acre-feet of water annually from the aquifer system. Water from the aquifer system is generally clear and lower in dissolved solids and sulfate than water in the overlying aquifer systems. Dissolved solids in water samples analyzed ranged from 504 to 1,680 milligrams per liter and averaged 1,050 milligrams per liter. (Woodard-USGS)  
W78-12727

**DIGITAL MODEL OF GROUND-WATER FLOW IN THE PICEANCE BASIN, RIO BLANCO AND GARFIELD COUNTIES, COLORADO,**  
Geological Survey, Lakewood, CO. Water Resources Div.  
J. B. Weeks.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 341, Price codes: A06 in paper copy, A01 in microfiche. Water-Resources Investigations 78-46, June 1978. 108 p, 6 fig, 2 tab, 12 ref.

**Descriptors:** \*Groundwater movement, \*Model studies, \*Computer models, \*Analytical techniques, \*Aquifer characteristics, Oil shales, Hydrogeology, Equations, \*Colorado, Rio Blanco County(Colo), Garfield County(Colo), \*Piceance basin(Colo), Unita Formation, Green River Formation.

The digital model used to simulate ground-water flow in the aquifer system in the basin drained by Piceance and Yellow Creeks in northwestern Colorado is described in detail. The model is quasi three-dimensional in that it simulates ground-water flow in a multi-aquifer system by assuming horizontal flow in the aquifers and vertical flow through the confining layers separating the aquifers. The model uses the iterative alternating-direction implicit procedure to solve the finite-difference flow equations. The digital model is documented by a program listing and flow charts. Data used in the model and sample output are presented to document the simulation of steady-state flow in the aquifer system. The variables used in the computer program and program options are discussed in detail. (Woodard-USGS)  
W78-12731

**HYDROLOGIC ANALYSIS OF THE U.S. BUREAU OF MINES' UNDERGROUND OIL-SHALE RESEARCH-FACILITY SITE, PICEANCE CREEK BASIN, RIO BLANCO COUNTY, COLORADO,**  
Geological Survey, Lakewood, CO. Water Resources Div.  
For primary bibliographic entry see Field 8B.  
W78-12732

**METHOD OF ESTIMATING NATURAL RECHARGE TO THE EDWARDS AQUIFER IN THE SAN ANTONIO AREA, TEXAS,**  
Geological Survey, Tuscaloosa, AL. Water Resources Div.  
C. Puente.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 364, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-10, April 1978. 34 p, 11 fig, 1 tab, 23 ref.

**Descriptors:** \*Groundwater recharge, \*Estimating, \*Methodology, \*Surface-groundwater relationships, \*Aquifer characteristics, Hydrogeology, Infiltration, \*Texas, \*Edwards aquifer(Tex), \*San Antonio area(Tex).

The method described for estimating annual recharge to the Edwards aquifer in the San Antonio area, Texas is basically the same method used by various investigators who have made recharge estimates dating back to 1934. The estimated annual recharge to the Edwards aquifer is shown by basin from 1934 to 1975. Recharge estimates made since 1953 are considered to be more accurate because gaging stations were installed after 1953 in several areas that were previously ungaged. Occasionally, the water-balance equations used for computed recharge are complicated by the occurrence of the heavy rain-storms in the infiltration area and in areas between the lower edge of the infiltration area and the lower gaging stations. In some of the computations, the outflow at the lower gage may be greater than the inflow at the upper gage. Under these conditions, the recharge is assumed to be zero only during certain times in the Blanco River basin, where high aquifer-head conditions produce discharge from the aquifer. In all other basins, estimates of runoff are adjusted to reflect the heavy rainfall in the area between the upper and lower gages. The long-term average estimate of annual recharge is probably representative of the true average, because the averaging procedure of the many estimates tends to cancel out the major errors. Monthly estimates of recharge during periods of high runoff probably contain the major errors. (Woodard-USGS)  
W78-12733

**PLAN OF STUDY FOR THE HIGH PLAINS REGIONAL AQUIFER-SYSTEM ANALYSIS IN PARTS OF COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA, SOUTH DAKOTA, TEXAS, AND WYOMING,**  
Geological Survey, Lakewood, CO. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W78-12739

**LAND SUBSIDENCE IN THE SANTA CLARA VALLEY,**  
Geological Survey, Sacramento, CA.  
J. F. Poland.  
Water Spectrum, Vol. 10, No. 2, Spring, 1978, p 11-16. 7 fig.

**Descriptors:** \*Land subsidence, \*Subsidence, \*Artesian heads, \*Pore pressure, \*California, \*Santa Clara Valley(Calif), Groundwater mining.

Land subsidence caused by the withdrawal of water is a particular problem of arid regions that depend heavily on groundwater to fill their water needs. Subsidence in the Santa Clara Valley of

California caused a total of about \$15-20 million of damages. It resulted from a decline in the artesian head and was stopped by raising the head to equal or exceed the maximum pore pressures in the Aquitards. If the artesian head is maintained at 1-20 feet above the 1971-73 levels, subsidence will not reoccur. (Russell-Arizona)  
W78-12941

## 2G. Water In Soils

**EFFECT OF RAINFALL AND SUBSEQUENT DRYING ON NITROGEN AND PHOSPHORUS CHANGES IN A DRYLAND FALLOW LOAM,**  
Department of Agriculture, Swift Current (Saskatchewan). Research Station.  
For primary bibliographic entry see Field 5B.  
W78-12109

**NEW ASPECTS OF SOIL FRACTURING IN CLAY,**  
Kentucky Univ., Lexington.  
For primary bibliographic entry see Field 8D.  
W78-12161

**COMPUTER ESTIMATES OF NATURAL RECHARGE THROUGH SOILS IN SOUTHERN ARIZONA, U.S.A.,**  
Geological Survey of Israel, Jerusalem; and Ben Gurion Univ. of the Negev, Beesheba (Israel). Inst. of Desert Research.  
For primary bibliographic entry see Field 2F.  
W78-12232

**EVALUATION OF LYOPHILIZATION METHOD OF DISAGGREGATING SAND, SILT AND CLAY,**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
E. F. Dolan, and M. A. Cashman.  
Technical Bulletin, No. 108, 35 p, 16 fig, 4 ref. (1978).

Descriptors: \*Sands, \*Silt, \*Clays, \*Freeze drying, Beds, \*Bottom sediments, Particle size, Degradation (Decomposition), Methodology, Analysis, Evaluation, \*Labconco Freeze Dryer - 3, \*Lyophilization method, \*Over-drying method.

The Sediment Survey program includes the collection of 'bed material' samples that are analyzed for particle size distribution. The present method of oven-drying requires vigorous grinding with a mortar and pestle to disaggregate the particles. The adaptation of the freeze dryer reduces this grinding time considerably. This report evaluates the freeze dryer or lyophilization method of disaggregating sands, silts and clays for particle size analysis and compares it with the oven-dried method presently used in the Sediment Laboratories of the Water Survey of Canada. (WATDOC)  
W78-12258

**DISSOLUTION OF ARSENIC FROM WATER-LOGGED AND AERATED SOIL,**  
Missouri Univ.-Columbia. Dept. of Agronomy.  
For primary bibliographic entry see Field 5B.  
W78-12267

**FLOW OF KAOLINITE AND SEWAGE-SLUDGE SUSPENSIONS IN SAND-SILT POROUS MEDIA,**  
Purdue Univ., Lafayette, IN. Water Resources Research Center.  
For primary bibliographic entry see Field 5B.  
W78-12606

**CLASSIFICATION AND ENGINEERING PROPERTIES OF DREDGED MATERIAL,**  
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.

For primary bibliographic entry see Field 8G.  
W78-12621

**FEASIBILITY STUDY OF GENERAL CRUST MANAGEMENT AS A TECHNIQUE FOR INCREASING CAPACITY OF DREDGED MATERIAL CONTAINMENT AREAS,**  
Texas A and M Research Foundation, College Station.  
For primary bibliographic entry see Field 8D.  
W78-12622

**ANALYSIS OF A CAPILLARY HYSTERESIS MODEL BASED ON A ONE-VARIABLE DISTRIBUTION FUNCTION,**  
Colorado State Univ., Fort Collins. Engineering Research Center.  
Y. Mualem, and H. J. Morel-Seytoux.  
Water Resources Research, Vol 14, No 4, p 605-610, August 1978. 11 fig, 12 ref. NSF ENG76-11542.

Descriptors: \*Hysteresis, \*Soil moisture, \*Model studies, \*Mathematical models, \*Theoretical analysis, Wetting, Drying, Soils, Porous media, Soil water, Soil water movement, Laboratory tests, Pores, Soil physics, Soil science, Model calibration, Drying curves.

Parlange's model corresponds to a special case of Mualem's similarity hypothesis ( $f(\psi \text{ sub } w, \psi \text{ sub } d) = h(\psi \text{ sub } w) / (h(\psi \text{ sub } d))$  in which  $h(\psi \text{ sub } d)$  is set at unity for all  $\psi$  values. Interpreted in terms of the soil water domain theory, this assumption implies that the relative pore volume of the domains is distributed uniformly in respect to the wetting radius (or to  $\psi \text{ sub } w$ ). In this paper the proper mathematical equation was derived for calibrating the model from the experimental main drying curve. The applicability of Parlange's model for the soil water hysteresis was analyzed theoretically and extensively tested for different types of porous media. Theoretical hysteric curves derived by direct implementation of Parlange's model were compared with experiments. These comparisons showed that Parlange's model contradicts well-known properties of the soil moisture characteristics. The good results reported by Parlange were not obtained when actual measured curves of the hysteresis loop were used. Whether the main branch of hysteresis for wetting or for drying is used in calibration, badly distorted shapes of hysteresis curves are obtained. Parlange's suggestion for calibrating the model on the basis of the main drying curve plus one additional point from the main wetting curve is considered too arbitrary to be reliable. (Sims-ISWS)  
W78-12628

**SOIL WATER FLOW MODEL WITH TWO-DIMENSIONAL AUTOMATIC GAMMA RAY ATTENUATION SCANNER,**  
Science and Education Administration, Riverside, CA. Salinity Lab.  
C. Dirksen, and M. J. Huber.  
Water Resources Research, Vol 14, No 4, p 611-614, August 1978. 2 fig, 17 ref.

Descriptors: \*Soil water movement, \*Moisture content, \*Laboratory tests, \*Instrumentation, Model studies, Soil water, Gamma rays, Moisture meters, Soil moisture meters, Automation, Automatic control, Equipment.

Described is a physical laboratory model to study two-dimensional transient water and solute transport in unsaturated soil, including water uptake by roots. It features an automatic two-dimensional gamma ray attenuation scanner for measuring soil water content. Automation is obtained with a simple closed loop control circuit. After a gamma count is transmitted to the teletypewriter, a signal is sent to the hydraulically moved scanner to search for the next grid point. Upon arrival, the scanner sends a signal back to initiate another data

acquisition sequence, and so on. In this way, synchronization between counter and scanner is assured independent of counting time, travel time, configuration of grid points, temporary slowdown, etc. It also eliminates dead time between grid points for any recording pattern. Grid points are established by an array of holes that trap the core of a solenoid actuator. The configuration of grid points can be changed easily by opening and closing the desired holes. This mechanical trapping was found to be simpler and more accurate than a potentiometric control. The soil water flow model is constructed in modules. It can be used as one unit of 3.15 by 1.07 by 0.178 m and inclined up to 30 degrees, or it can be subdivided into up to 8 compartments, each with its own drainage filter tubes. The front glass walls allow visual observations of soil packing, wetting fronts, root distribution, etc. The back aluminum walls allow installation of instruments, such as tensiometers, salinity sensors, and psychrometers. (Sims-ISWS)  
W78-12629

**A FIELD-MEASURING INSTRUMENT OF SATURATED PERMEABILITY KF IN UNDISTURBED SOIL SAMPLES BY THE CORE-SAMPLER METHOD,**  
Geologisches Landesamt Nordrheinwestfalen, Krefeld (West Germany).  
W. Kley, and U. Krahmer.  
Ground Water, Vol 16, No 5, p 354-356, September-October 1978. 4 fig, 10 ref.

Descriptors: \*Permeability, \*Sampling, \*Equipment, \*Cores, Soil water, Saturated flow, Saturated soils, Measurement, On-site data collections, Instrumentation, Soil physics, Soil science, Soil core samplers.

A field instrument to determine saturated permeability (kf) was presented. It is possible to take several samples and obtain measurements quickly. The instrument, adapted for a series of measurements, permits the identification of erroneous values and allows repeated measurements. Calculating permeability values through self-made tables or nomograms make field results immediately available for the description of the cross section. Transporting the samples to the laboratory is no longer required. The instrument is sturdy and requires little maintenance. (Sims-ISWS)  
W78-12638

**RELATIONSHIPS BETWEEN SOIL SALINITY AND THE SALINITY OF APPLIED WATER IN THE SUISUN MARSH OF CALIFORNIA,**  
California State Dept. of Fish and Game, Sacramento. Wildlife Management Branch.  
G. L. Rollins.  
California Fish and Game, Vol 59, No 1, p 5-35, January, 1973. 15 fig, 4 tab, 16 ref.

Descriptors: \*Salinity, \*Soil chemistry, \*Water quality, \*Waterfowl, \*Leaching, \*Marshes, Wetlands, Rooted aquatic plants, California, Soil chemical properties, Suisun Marsh(CA).

Part I of this investigation was conducted on four private duck clubs under water management practices typical of those used throughout the suisun marsh. Part II was conducted in a test pond where water management and surface water salinities were controlled. A significant correlation existed between the salinity of applied water and the salinity in the first and second feet of soil. The flooding of marsh soils with highly saline water, under present marsh management practices, would greatly increase existing soil salinities. The leaching of marsh soils by alternate flooding and draining with low salinity water was an effective means of reducing soil salinity. The type of water management practiced by the duck clubs produced extremely high soil salinities which inhibit the production of valuable waterfowl food plants. Leaching is recommended as a general practice in Suisun Marsh to enhance the production of the



## Field 2—WATER CYCLE

### Group 2G—Water In Soils

more important waterfowl food plants. A water management schedule is provided as a guide to duck club owners and operators to maximize waterfowl food production. (Stihler-Mass)  
W78-12692

**SURFACE HYDROLOGY OF PEATLANDS,**  
Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.  
For primary bibliographic entry see Field 2H.  
W78-12708

**MINNESOTA'S PEAT RESOURCES: THEIR CHARACTERISTICS AND USE IN SEWAGE TREATMENT, AGRICULTURE AND ENERGY,**  
Minnesota Univ., St. Paul. Dept. of Soil Science.  
For primary bibliographic entry see Field 5D.  
W78-12717

**RESISTANCE TO WATER UPTAKE IN A DOUGLAS FIR FOREST,**  
British Columbia Univ., Vancouver. Dept. of Soil Science.  
For primary bibliographic entry see Field 2I.  
W78-12840

**THERMODYNAMIC EQUILIBRIUM BETWEEN ICE AND WATER IN POROUS MEDIA,**  
Norwegian Geotechnical Inst., Oslo (Norway).  
For primary bibliographic entry see Field 2C.  
W78-12841

**SOIL WATER RETENTION AS RELATED TO PARTICLE SIZE IN SELECTED SANDS AND LOAMY SANDS,**  
Bureau of Reclamation, Bismark, ND. Missouri-Souris Projects Office.  
E. D. Rivers, and R. F. Shipp.  
Soil Science, Vol 126, No 2, p 94-100, August 1978. 1 fig, 3 tab, 7 ref.

Descriptors: \*Soil water, \*Particle size, \*Soil texture, \*North Dakota, Soils, Sands, Loam, Laboratory tests, Soil tests, Retention, Soil types, Field capacity, Soil science, \*Soil water retention, \*Glacial Lake Souris basin(ND).

Sands and loamy sand within the Glacial Lake Souris basin in North Dakota vary considerably from one area to another in their particle size distribution. The objective was to relate water retention of these sandy soil textural classes to particle size percentage. Water retention percentages, on an oven-dry basis, were determined for samples at field capacity under field conditions and also at 1/10-, 1/15-, and 1/20-bar soil water suction for air-dried, less than 2-mm samples in conventional porous ceramic plate-pressure pot equipment. No single soil water suction produced water retention values adequately representing field capacity for all textures. In most instances, the percentage of very fine sand alone and in combinations with the percentages of silt and clay were correlated significantly with soil water values. (Sims-ISWS)  
W78-12842

**FIELD CALIBRATION AND USE OF THE NEUTRON MOISTURE METER ON SOME NIGERIAN SOILS,**  
Ibadan Univ. (Nigeria). Dept. of Agronomy.  
O. Babalola.  
Soil Science, Vol 126, No 2, p 118-124, August 1978. 4 fig, 2 tab, 23 ref.

Descriptors: \*Nuclear moisture meters, \*Calibrations, \*Instrumentation, \*Moisture content, On-site investigations, Laboratory tests, Soils, Soil types, Soil texture, Moisture meters, Measurement, Equipment, Soil water, Curves, Soil properties, Soil science, \*Nigeria.

This investigation was carried out because of a need to monitor soil moisture content periodically in the field. The neutron probe equipment (Troxler, model 104 A) was calibrated in the field on 4 soil profiles of contrasting soil physical properties. The effects of gravel content and gravel mineralogical composition on the thermalization of neutrons also were investigated in the laboratory. An oil drum was filled with mixtures of gravel and a subsoil fine earth fraction. Gravel concentrations of 0, 50, and 75% were used. Quartz gravel and iron/manganese concretions were used separately. The correlation coefficient of the regression equation,  $Y = a + bx$ , where Y is the count ratio and x is the moisture content, which was obtained for the different soil layers in the field, ranged between 0.84 and 0.98. The lower correlation coefficient, obtained mostly in the gravelly layers, was attributed to both spatial variability of the soil physical properties and the inherent problem associated with gravimetric moisture determination in gravelly soils. Although it was possible to establish one single calibration curve for all soils and depths ( $r = 0.89$ ), the use of the curve to infer absolute moisture content would lead to an appreciable error. Also, the factory calibration curve will find its best use only in interpreting relative changes in moisture content. (Sims-ISWS)  
W78-12843

**LONGITUDINAL AND TRANSVERSE DISPERSION COEFFICIENTS IN UNSATURATED PLAINFIELD SAND,**  
Wisconsin Univ.-Madison. Dept. of Soil Science.  
D. F. Yule, and W. R. Gardner.  
Water Resources Research, Vol. 14, No. 4, p 582-588, August 1978. 7 fig, 2 tab, 19 ref.

Descriptors: \*Dispersion, \*Soils, \*Sands, \*Laboratory tests, Equipment, Instrumentation, Data processing, Mathematical models, Inflow, Discharge(Water), Soil water, Pore water, Soil water movement, Velocity, Unsaturated flow, Diffusion, Soil physics, Soil science, Transverse dispersion, Longitudinal dispersion, Soil columns.

The relationship between the longitudinal and transverse dispersion coefficients ( $D_{sub L}$  and  $D_{sub T}$ ) and the pore water velocity ( $v$ ) and the effective diffusion coefficient ( $D_{sub e}$ ) was determined for  $v$  between 0.01 and 0.28 cm/min in a vertical unsaturated column ( $L = 23$  cm) of C horizon Plainfield sand. The inflow and outflow control systems on the soil column consisted of rows of porous ceramic tubes with individual adjustable pressure controls. Uniform inflow and outflow were achieved across the column, and  $v$  was maintained constant during each experiment. An analysis of the transverse spread produced indicated that the effect of apparatus-induced dispersion was less than 10%.  $D_{sub L}$  ( $sq\ cm/min$ ) was linearly related to  $v$  ( $cm/min$ ) ( $D_{sub L} = 0.216v + 0.0032$ ;  $sq\ r = 0.90$ ). Slightly larger  $D_{sub L}$  was found in experiments with  $H_2O$  replacing  $Cl$  than in experiments with  $Cl$  replacing  $H_2O$ .  $D_{sub L}$  at the lowest  $v$  was 2 orders of magnitude greater than  $D_{sub e}$ .  $D_{sub T}$  ( $sq\ cm/min$ ) was essentially independent of  $v$  ( $D_{sub T} = 0.0035v + 0.0031$ ;  $sq\ r = 0.15$ ) and was about 2 orders of magnitude greater than  $D_{sub e}$  at the lowest  $v$  studied. The spread of tracer at the outflow was inversely proportional to  $v$ , and transverse dispersion had reduced the concentration peak of the inflow by 84% at  $L = 23$  cm and  $v = 0.01$  cm/min. The ratio  $D_{sub L}/D_{sub T}$  was proportional to  $v$  and ranged from about  $1(v = 0.01\ cm/min)$  to about  $20(v = 0.28\ cm/min)$ . (Sims-ISWS)  
W78-12852

**RAPID ESTIMATE OF UNSATURATED HYDRAULIC CONDUCTIVITY FUNCTION,**  
Agricultural Research Organization, Bet Dagan (Israel). Div. of Soil Physics.  
E. Bresler, D. Russo, and R. D. Miller.

Soil Science Society of America Journal, Vol. 42, No. 1, p 170-172, January-February 1978. 4 fig, 10 ref.

Descriptors: \*Hydraulic conductivity, \*Unsaturated flow, \*Infiltration, \*Estimating equations, Laboratory tests, Soil physical properties, Pore pressure, Pore water, Horizontal infiltration, Wetting front, Nonsodic soils, Air entry value.

From results of Reichardt, Nielsen, and Biggar and of Russo and Bresler, it was inferred that a laboratory horizontal infiltration experiment with air-dry soil yields an estimate of the saturated-unsaturated hydraulic conductivity function given by  $K(h) = 0.27(m\ to\ the\ 4th\ power)(h\ sub\ e/h)\ to\ the\ 2.6\ power\ or\ K(\theta) = 0.27(m\ to\ the\ 4th\ power)(\theta - \theta_{sub\ d})/(\theta - \theta_{sub\ w} - \theta_{sub\ d})\ to\ the\ 7.2\ power$ . Here  $m = dx/dt$  (to the 1/2 power);  $x$  is distance to the wetting front and  $t$  is infiltration time;  $\theta_{sub\ d}$  and  $\theta_{sub\ w}$  are water contents of air-dry and 'unsaturated' soil;  $h$  is pore water pressure head, and  $h\ sub\ e$  is the air entry value of  $h$ . These relationships can serve as a general approximation of  $K(\theta)$  and  $K(h)$  in nonsodic stable soils. Field measurements of  $h\ sub\ e$  and saturated  $K$  can also be used to derive  $K(\theta)$  and  $K(h)$ . (Visocky-ISWS)  
W78-12853

**LEACHING CHARACTERISTICS OF A LAYERED FIELD SOIL,**  
Connecticut Agricultural Experiment Station, New Haven.  
J. L. Starr, H. C. DeRoo, C. R. Frink, and J. Y. Parlange.  
Soil Science Society of America Journal, Vol. 42, No. 3, p 386-391, May-June 1978. 8 fig, 18 ref.

Descriptors: \*Groundwater movement, \*Percolating water, \*Soil physical properties, \*Soil leaching, \*Infiltration, Leaching, Percolation, Soil chemistry, Movement, Chemical properties, Solutes, Solubility, Soil water movement, Physical properties, Saturated flow, \*Solute movement, \*Ponded infiltration, \*Leaching characteristics, \*Percolating water movement, Fingering, Instability, Ponded-flow infiltration.

Two ponded flow experiments were conducted to study the leaching characteristics of a layered field soil, fine sandy loam over coarse sand, with a water table at a depth of 1.8 m. In the first experiment, a steel cylinder 1.8 m in diameter was driven into a soil to a depth of 3.6 m. Infiltrations of water and dye provided the means for direct observation of the effect of air entrapment upon the rates of infiltration as well as the primary pattern of water flow through the coarse subsoil. The rate of infiltration was observed to increase by nearly two-fold when the entrapped air between the saturated surface layer and the shallow groundwater table was vented directly to the atmosphere. Removal of the soil layers following infiltration of a dye solution showed that most of the infiltrating water moved through fingers ranging from 5 to 20 cm in diameter. In the second experiment, chloride distributions at six depths were measured following the application of a pulse of 0.3N  $CaCl_2$  solution to the soil surface. Chloride movement for the 20- to 60-cm soil depths averaged about 50% slower than that determined from the average pore-water velocity at the soil surface. In contrast to this relatively low rate of chloride movement, several salt pulses reached the 120- and 180-cm depths soon after or before reaching the 60-cm depth. This greatly increased flow rate corresponds to the observations in the first experiment where flow became unstable and the solute moved in fingers of flow below the 60-cm depth. (Henley-ISWS)  
W78-12854

**STRAW-MULCH RATE EFFECT ON SOIL WATER STORAGE AND SORGHUM YIELD,**  
Southwestern Great Plains Research Center, Bushland, TX.



## WATER CYCLE—Field 2

### Lakes—Group 2H

For primary bibliographic entry see Field 3F.  
W78-12855

#### EFFECT OF LYSIMETER MATERIALS ON INDICES OF LYSIMETRIC WATER CHEMICAL COMPOSITION (IN RUSSIAN),

Akademiya Nauk SSSR, Leningrad. Pochvennyi Inst.  
B. F. Govorenkov.  
Pochvovedenie (6), p 41-49, 1977.

Descriptors: \*Lysimeters, \*Chemical degradation, \*Acidity, \*Soil water, Chemical reactions, Iron, Acidic soils, Zinc.

The results of long-term field and laboratory experiments showed that the lysimeters made of galvanized Fe are not chemically resistant to an acid soil medium. When they interact with soil solution they release Zn into solution, leading to considerable changes in chemical composition of the latter, especially, with regard to its acidity. Lysimeters made of vinyl-plast do not effect the composition of lysometric water.—Copyright 1978, Biological Abstracts, Inc.  
W78-12942

#### A MODEL SYSTEM TO STUDY THE DESORPTION AND BIOLOGICAL AVAILABILITY OF PCB IN HYDROSOILS,

Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.  
For primary bibliographic entry see Field 5B.  
W78-12980

## 2H. Lakes

#### ANALYSIS FOR POLYCHLORINATED BIPHENYLS IN LAKE MACATAWA BOTTOM SEDIMENTS,

Hope Coll., Holland, MI. Dept. of Chemistry.  
For primary bibliographic entry see Field 5A.  
W78-12105

#### A COMPARATIVE ECOLOGICAL STUDY OF THE CALIFORNIA CRAYFISH, PACIFASTACUS ZENIUSCULUS (DANA), FROM TWO SUBALPINE LAKES,

California Univ., Davis. Div. of Environmental Studies.  
C. R. Goldman, and J. C. Rundquist.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 798, Price codes: A02 in paper copy, A01 in microfiche. Presented at Proc. 3rd International Symposium Freshwater Crayfish. Kuopio, Finland, Dec 1976. 22 p, 9 fig, 5 tab, 19 ref. (California Water Resources Center Project UCAL-WRC-W-475) OWRT A-056-CAL(1).

Descriptors: \*Crayfish, \*Lakes, Limnology, Ecology.

Crayfish growth and population density were determined and compared for Pacifastacus leniusculus (Dana) populations in two closely situated but limnologically distinct Sierra-Nevada lakes, Lake Tahoe (California-Nevada) and Donner Lake (California). Physical, chemical and biological parameters for the lakes were also compared to determine whether differences observed in the crayfish populations could be related to broad limnological characteristics of the lakes. The crayfish population in mesotrophic Donner Lake was considerably less dense than in ultraoligotrophic Lake Tahoe. The implication of this finding for crayfish production management is discussed. A brief discussion of possible genetic differences between the two crayfish populations, based on gel electrophoresis, is also presented. (Snyder-Calif, Davis)  
W78-12112

#### DISTRIBUTION OF PHYTOPLANKTON IN VIRGINIA LAKES,

Nevada Univ., Las Vegas. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12122

#### DISTRIBUTION OF PHYTOPLANKTON IN TENNESSEE LAKES,

Nevada Univ., Las Vegas. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12123

#### RELATIONSHIPS OF PRODUCTIVITY AND PROBLEM CONDITIONS TO AMBIENT NUTRIENTS: NATIONAL EUTROPHICATION SURVEY FINDINGS FOR 418 LAKES,

Environmental Monitoring and Support Lab., Las Vegas, NV.  
For primary bibliographic entry see Field 5C.  
W78-12124

#### DISTRIBUTION OF PHYTOPLANKTON IN OHIO LAKES,

Nevada Univ., Las Vegas. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12126

#### DISTRIBUTION OF PHYTOPLANKTON IN NEW JERSEY LAKES,

Environmental Monitoring and Support Lab., Las Vegas, NV.  
For primary bibliographic entry see Field 5C.  
W78-12127

#### DISTRIBUTION OF PHYTOPLANKTON IN GEORGIA LAKES,

Nevada Univ., Las Vegas. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12128

#### DISTRIBUTION OF PHYTOPLANKTON IN KENTUCKY LAKES,

Environmental Monitoring and Support Lab., Las Vegas, NV.  
For primary bibliographic entry see Field 5C.  
W78-12129

#### EVAPOTRANSPIRATION FROM WATER HYACINTH IN TEXAS RESERVOIRS,

Texas A and M Univ., College Station. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2D.  
W78-12155

#### ESTABLISHING BASELINE DATA FOR MANAGEMENT OF HALIFAX, N.S., LAKE WATERSHEDS,

Nova Scotia Technical Coll., Halifax. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5A.  
W78-12159

#### A COMPARISON OF THE ZOOPLANKTON OF LAKE KAINJI AND OF THE RIVERS NIGER AND SWASHI,

Reading Univ. (England). Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W78-12201

#### AN INTRODUCTION TO THE LIMNOLOGY OF THE FRIESIAN LAKES,

Limnological Inst., Oosterzee (Netherlands). Tjeukemeer Field Station.  
For primary bibliographic entry see Field 5A.  
W78-12202

#### DIEL FEEDING AND RESPIRATION RHYTHMS IN ZOOPLANKTON,

Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12203

#### INTERACTIONS BETWEEN SEDIMENTS AND OVERLYING WATERS IN AN EXPERIMENTALLY EUTROPHIED PRECAMBRIAN SHIELD LAKE,

Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.  
For primary bibliographic entry see Field 5C.  
W78-12204

#### AN ASSESSMENT OF PRINCIPAL COMPONENT ANALYSIS FOR DESCRIPTION OF PHYTOPLANKTON PERIODICITY IN LAKE WINGRA,

Wisconsin Univ.-Madison. Lab. of Limnology.  
For primary bibliographic entry see Field 5C.  
W78-12209

#### SUMMARY ANALYSIS OF THE NORTH AMERICAN (U.S. PORTION) OECD EUTROPHICATION PROJECT: NUTRIENT LOADING-LAKE RESPONSE RELATIONSHIPS AND TROPIC STATE INDICES,

Texas Univ., at Dallas, Richardson. Center for Environmental Studies.  
For primary bibliographic entry see Field 5C.  
W78-12245

#### DISTRIBUTION AND IMPORTANCE OF PHYTOPLANKTON IN THE ATCHAFALAYA BASIN,

Nevada Univ., Las Vegas. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12246

#### DISTRIBUTION OF PHYTOPLANKTON IN DELAWARE LAKES,

Environmental Monitoring and Support Lab., Las Vegas, NV.  
For primary bibliographic entry see Field 5C.  
W78-12248

#### IFYGL TEMPERATURE TRANSECTS, LAKE ONTARIO, 1972,

Canada Centre for Inland Waters, Burlington (Ontario); and Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.  
F. M. Boyce, and C. H. Mortimer.  
Technical Bulletin No. 100, 1977, 315 p, 13 ref, 111 fig, 9 tab, 2 append.

Descriptors: \*Lake Ontario, \*Cross-sections, \*Temperature distribution, \*Thermocline, \*Measurement, Depth, Isotherms, Data collections, On-site data collections, Surveys, Internal waves, Standing waves, Time series analysis, Instrumentation, Ships, Bathymetry, Bathythermographs, Canada, \*International Field Year on the Great Lakes (IFYGL), Moored temperature profiles.

During the International Field Year on the Great Lakes (IFYGL) a sequence of experiments was carried out on Lake Ontario wherein it was attempted to measure the temperature structure across three vertical cross sections of the lake simultaneously and continuously for periods of at least four days. Experiments were carried out in July, August, and October of 1972 using up to three research vessels equipped with standard and towed temperature profiling devices. The data have been presented as sequences of cross sections of the lake showing the depths of selected isotherms as functions of horizontal distance and time. The data contain striking examples of both

## Field 2—WATER CYCLE

### Group 2H—Lakes

large- and small-scale internal waves, standing and progressive. A very limited discussion of the data in terms of the dynamics of basin-wide internal standing waves is given, since it is intended that this publication be viewed primarily as a data report. Time series plots of isotherm depths from moored temperature profiles are included where they overlap the ship surveys. Data from the coastal chain surveys have been used to extend the measurements shorewards and to verify the ship-based measurements. The instrumentation used to obtain the profiles is described in some detail. A considerable effort has been expended to make the report as complete as possible to facilitate the interpretation of the data for future researchers. (WATDOC)  
W78-12256

**THE ESTIMATION OF SAMPLE SIZE REQUIRED IN CHEMICAL LIMNOLOGY AND AUTECOLOGY OF SHELLED INVERTEBRATES,**  
Canada Centre for Inland Waters, Burlington (Ontario).  
For primary bibliographic entry see Field 7B.  
W78-12262

**THE POLLUTION OF NATURAL RIVER BED SEDIMENTS BEHIND THE SAVA RIVER ARTIFICIAL DAM (IN SLOVENIAN),**  
For primary bibliographic entry see Field 5A.  
W78-12271

**EFFICIENT PRESSURE SOLUTION FOR CIRCULATION PREDICTION,**  
Ohio State Univ., Columbus. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 8B.  
W78-12281

**INVESTIGATION ON DRILLING CORES OF SEDIMENTS OF LAKE CONSTANCE: I. PROFILES OF THE POLYCYCLIC AROMATIC HYDROCARBONS (IN GERMAN),**  
Biochemisches Inst. Umweltcarcinogene, Ahrensburg (West Germany).  
For primary bibliographic entry see Field 5A.  
W78-12290

**MAIN ASPECTS OF THE ANTHROPOGENIC TRANSFORMATION OF LAKE ECOSYSTEM OF THE NORTHWESTERN EUROPEAN USSR (IN RUSSIAN),**  
Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.  
I. I. Nikolaev.  
Gidrobiol Zh 13(2), p 5-13, 1977.

Descriptors: Ecosystems, Environmental effects, Water level fluctuations, \*Hydroelectric powerplants, \*Lake ecosystems, Ponds, Discharge, Fish, \*Ichthyosides, Invertebrates, \*Thermal pollution, Water pollution control.

The main anthropogenic aftereffects on the lake ecosystems were analyzed on the basis of data from literature and results of actual studies. Examples are given of complete rearrangement of small lake ecosystems by applying ichthyocides with subsequent introduction of valuable ichthyofauna; in ponds this was done by fertilizer application. In large lakes the aftereffects of the transformation into hydroelectric plant reservoirs and variations in the level evoked by this transformation were considered; ecosystems of medium lakes were affected by lowering of the water level used for irrigation. The effect of thermal waters from the state regional power station on hydrobionths of the reservoir was analyzed. Examples of settling fish, invertebrates and water plants are given. Copyright 1978, Biological Abstracts, Inc.  
W78-12298

**MACRO-NUTRIENTS IN THE LAKE GEORGE ECOSYSTEM,**  
Rensselaer Polytechnic Inst., Troy, NY.  
For primary bibliographic entry see Field 5C.  
W78-12304

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 3: MILWAUKEE COUNTY,**  
Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison.  
For primary bibliographic entry see Field 2J.  
W78-12314

**CHICAGO LAKEFRONT DEMONSTRATION PROJECT. ENVIRONMENTAL IMPACT HANDBOOK,**  
Chicago, IL, Dept. of Development and Planning.  
P. C. Ryner.  
Illinois Coastal Zone Management Program, 'Chicago Lakefront Demonstration Project'. (1978) 76 p, 2 fig, 3 tab, 3 append.

Descriptors: \*Coasts, Environment, Management, Lakes, Environmental effects, \*Chicago(Lakefront), Illinois, \*Environmental impact, Handbook, \*Lake Michigan, Coastal zone management.

This handbook has been designed to serve as a guide in assessing the environmental effects of project developed in accordance with 'The Lakefront Plan of Chicago (1972)'. This handbook assumes that lakefront development has been identified by the City as being a potentially desirable activity and that there is a fairly clear idea as to what public objectives such development would hope to meet. It presents a time- and cost-effective approach to environmental analysis that can improve the environmental soundness of the planning and design process; facilitate the granting of City and State permits; and lead to the submission of a clear, concise, and technically adequate Environmental Impact Assessment to the U.S. Army Corps of Engineers as part of their required permit application process. (NOAA)  
W78-12315

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 1: KENOSHA COUNTY,**  
Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison.  
For primary bibliographic entry see Field 2J.  
W78-12336

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 8: MILWAUKEE COUNTY, SUMMARY OF ENGINEERING BORING LOGS,**  
Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison.  
For primary bibliographic entry see Field 2J.  
W78-12338

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 5: SHEBOYGAN COUNTY,**  
Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison.  
For primary bibliographic entry see Field 2J.  
W78-12367

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 6: SOUTHERN AND CENTRAL MANITOWOC COUNTY,**  
Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison.  
For primary bibliographic entry see Field 2J.  
W78-12360

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 5: SHEBOYGAN COUNTY,**  
Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison.  
For primary bibliographic entry see Field 2J.  
W78-12367

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 4: OZAUKEE COUNTY,**  
Wisconsin Geological and Natural History Survey, Madison; Wisconsin Dept. of Natural Resources, Madison; and Wisconsin Office of State Planning and Energy, Madison.  
For primary bibliographic entry see Field 2J.  
W78-12392

**THE TALE OF A LAKE,**  
Transvaal Provincial Administration, Pretoria (South Africa). Div. of Nature Conservation.  
G. L. Lombard.  
Environment RSA (Pretoria), Vol. 2, No. 5, p 2-3, 1975.

Descriptors: \*Freshwater lakes, Aquatic insects, \*Ecological studies, Acid mine drainage, Acidification, De-acidification, Lake limnology, Sulphur pollution, pH effect, Recreational water, Reclamation, Pyrite, Lime addition, Pollution sources, Ecology, Lake stages, Freshwater fish, Aquatic plants, Water birds, Arundo, \*Germiston lake, \*Chironomidae, South Africa.

The author describes the deterioration of Germiston lake, a small lake of 57ha in extent in the heart of the mining town of Germiston. This previously popular recreational lake was slowly polluted due to acid mine drainage from the nearby mine dumps, to a point where the water had a pH of 4.2. All plant, animal and insect life in the lake died off except for two kinds of gnats of the family Chironomidae, which found conditions ideal and in the absence of competitors a population explosion occurred which made life unbearable for persons living near the lake. The Transvaal department of nature conservation was called in to help and by addition of spent caustic soda and agricultural lime, the pH was pushed up to a more acceptable 6.0, at which point others forms of water insects and plants returned to the lake and natural conditions were again established after restocking the lake with fish. (So Afr Water Info Ctr)  
W78-12413

**NITROGEN AND PHOSPHORUS INPUT TO THE MIDMAR DAM, NATAL,**  
Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research.  
For primary bibliographic entry see Field 5C.  
W78-12491

**THE DISTRIBUTION OF NUTRIENTS IN SWARTVLEI, A SOUTHERN CAPE COASTAL LAKE,**  
Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.  
For primary bibliographic entry see Field 5B.  
W78-12493

**STUDIES OF PHYTOPLANKTON BIOGENIC ELEMENT REQUIREMENTS IN DIFFERENT TYPES OF LAKES USING A METHOD OF PLANNED SUPPLEMENTS (IN RUSSIAN),**  
Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.  
For primary bibliographic entry see Field 5C.  
W78-12514

**CHEMICAL CHARACTERISTICS OF LAKE MARYUT, A POLLUTED LAKE SOUTH OF ALEXANDRIA, EGYPT,**  
Alexandria Inst. of Oceanography and Fisheries (Egypt).  
For primary bibliographic entry see Field 5A.  
W78-12520

**SOME REGULARITIES IN THE CHANGES IN LAKE ECOSYSTEMS IN CONNECTION WITH ANTHROPOGENIC FACTORS (IN RUSSIAN),**  
Polish Academy of Sciences, Warsaw. Inst. of Ecology.  
Z. Kajak.  
Gidrobiol Zh 13(2), p 14-22, 1977.

Descriptors: \*Lakes, \*Ecosystems, \*Eutrophication, \*Plankton, \*Aquatic productivity, \*Biological communities, Variability, Nutrient requirements, Benthos, Productivity, Trophic level, Heating, Thermal stress, Surface waters, Population, Carp, Water temperature, Self-purification, Carp, Dreissena, Heating, Lakes, Masurian, Poland, Pollution, Silver, Tubificids.

Recent studies demonstrated rapid eutrophication of the Masurian Lakes, Poland. Data were collected on nutrition of dominant species of plankton and benthos (Dreissena, tubificids) and their role in the ecosystem. The production and efficiency of production of different trophic levels in different bodies of water were determined, as well as energy dynamics in the lake ecosystem. Heating of the water had a positive effect on its self-purification but negatively affected a polluted river. Introduction of silver carp reduced the plankton population, and introduction of carp significantly affected the structure of the biocenosis. Under certain conditions, both fish may be used for purification of water from secondary pollution. Copyright 1978, Biological Abstracts, Inc.  
W78-12557

**SEASONAL VARIABILITY IN THE BIOCHEMICAL COMPOSITION OF PLANKTON IN THE MINGECHAUR AND VARVARA RESERVOIRS (IN RUSSIAN),**  
Akademiya Nauk Azerbaidzhanskoi SSR, Baku. Inst. Zoologii.  
S. B. Gadzhieva.  
Gidrobiol Zh 13(4), p 70-75, 1977.

Descriptors: \*Plankton, Reservoirs, Seasonal, Mingechaur Reservoir(USSR), Varvara Reservoir(USSR), \*Caloric content, \*Carbohydrates, \*Dry matter, \*Fat, \*Protein, USSR.

Seasonal changes between 1969 and 1970 were traced for plankton content of dry matter, fat, proteins, carbohydrates and caloric content. The content of dry matter apparently was maximum in spring and in winter (1970) in the Varvarian reservoir (USSR). Fat content and caloric content of plankton increased from spring to winter. The maximum values were in autumn, the minimum in summer (1970) only in the Varvarian reservoir. The protein content in 1969 increased from spring

to autumn and in 1970 the maximum was observed in summer, the minimum in winter. Carbohydrate amount in plankton decreased from spring to winter. Copyright 1978, Biological Abstracts, Inc.  
W78-12560

**REMOTE SENSING TO IDENTIFY, ASSESS, AND PREDICT ECOLOGICAL IMPACT ON LAKE CHAMPLAIN WETLANDS,**  
State Univ. of New York Coll. at Plattsburgh.  
For primary bibliographic entry see Field 6G.  
W78-12601

**FLUCTUATION OF OXYGEN CONCENTRATION IN LAKE BLED DURING THE YEARS 1974-1976 (IN SLOVENIAN),**  
Ljubljana Univ. (Yugoslavia). Dept. of Biology.  
For primary bibliographic entry see Field 5B.  
W78-12613

**ENERGETICS OF A SALMON LAKE ECOSYSTEM (IN RUSSIAN),**  
Akademiya Nauk SSR, Moscow. Inst. Biologii Vnutrennykh Vod.  
For primary bibliographic entry see Field 5C.  
W78-12614

**SPECIES COMPOSITION OF PHYTOPLANKTON FROM DIFFERENT TYPES OF LAKES IN THE CENTRAL KARELIAN ISTHMUS (IN RUSSIAN),**  
Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.  
For primary bibliographic entry see Field 5C.  
W78-12620

**OPTIMIZATION OF LAKE HYDROGRAPHIC SURVEYS,**  
National Swedish Environment Protection Board, Uppsala (Sweden). Limnological Survey.  
For primary bibliographic entry see Field 7C.  
W78-12624

**ATMOSPHERIC NITROGEN AND PHOSPHORUS LOADING TO HARP LAKE, ONTARIO, CANADA,**  
Ontario Ministry of the Environment, Rexdale (Ontario). Water Resources Branch.  
For primary bibliographic entry see Field 5B.  
W78-12626

**CIRCULATION PATTERNS IN THE FOX CHAIN OF LAKES IN ILLINOIS,**  
Illinois State Water Survey, Urbana.  
N. G. Bhowmik, and J. B. Stall.  
Water Resources Research, Vol 14, No 4, p 633-642, August 1978. 10 fig, 1 tab, 20 ref.

Descriptors: \*Water circulation, \*Lakes, \*Winds, \*Illinois, On-site investigations, On-site data collections, Circulation, Shallow water, Water bodies, Inflow, Discharge(Water), Flow, Rivers, Laboratory tests, Model studies, Mathematical models, Data processing, Limnology, \*Fox Chain of Lakes(III).

Extensive circulation data were collected at 7 locations on 5 different occasions during 1975 in the Fox Chain of Lakes in Illinois. In areas of negligible inflow, the circulation patterns in all of the lakes were governed by the wind. Even in areas of significant inflow, the wind dominated the movement of water as soon as diffusion of the inflow jets reduced the flow velocity. Generally, the surface water moved with the wind and there was some return flow below certain depths. Measured wind-generated current profiles in the lakes indicated that they generally follow a logarithmic distribution. The wind factor defined as the ratio of surface water velocity to wind velocity varied from 2 to 7%. Theoretical circulation patterns in

Pistakee Bay for a few selected wind conditions were computed by a finite element method. Computer plots were developed, and the theoretical circulation patterns were compared with the measured circulation patterns. Correlation between the theoretical and measured circulation patterns was found to be good. (Sims-ISWS)  
W78-12633

**DIFFERENCES IN RADAR RETURN FROM ICE-COVERED NORTH SLOPE LAKES,**  
Army Terrestrial Sciences Center, Hanover, NH.  
For primary bibliographic entry see Field 2C.  
W78-12639

**ICE GROWTH IN DULUTH-SUPERIOR HARBOR,**  
Minnesota Univ., Duluth. Dept. of Physics.  
For primary bibliographic entry see Field 2C.  
W78-12640

**INTEGRAL EQUATION FAILURE IN WAVE CALCULATIONS,**  
New Orleans Univ., LA. Dept. of Physics.  
For primary bibliographic entry see Field 2L.  
W78-12642

**DISSOLVED SILICA IN PORE WATERS OF LAKES ONTARIO, ERIE, AND SUPERIOR SEDIMENTS,**  
Canada Centre for Inland Waters, Burlington (Ontario).  
For primary bibliographic entry see Field 2J.  
W78-12645

**COMMUNITY STRUCTURE, DYNAMICS AND NUTRIENT CYCLING IN THE OKEFENOKEE CYPRESS SWAMP-FOREST,**  
California Univ., Santa Barbara. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 2I.  
W78-12679

**THE INFLUENCE OF FLOATING VASCULAR PLANTS ON THE DIURNAL FLUCTUATIONS OF TEMPERATURE NEAR THE WATER SURFACE IN EARLY SPRING,**  
Guelph Univ. (Ontario). Dept. of Botany and Genetics.  
For primary bibliographic entry see Field 2I.  
W78-12688

**REMOTE SENSING FOR IDENTIFICATION AND CLASSIFICATION OF WETLAND VEGETATION,**  
Fisheries and Wildlife, Jamestown ND. Northern Prairie Wildlife Research Center.  
For primary bibliographic entry see Field 2I.  
W78-12689

**WATERFOWL USE OF UTAH MOUNTAIN WETLANDS IN UTAH,**  
Utah Cooperative Wildlife Research Unit, Logan.  
For primary bibliographic entry see Field 2I.  
W78-12693

**CHANGES IN SUBMERGED PLANTS AT THE SOUTH END OF CAYUGA LAKE FOLLOWING TROPICAL STORM AGNES,**  
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.  
R. T. Oglesby, A. Vogel, J. H. Peverly, and R. Johnson.  
Hydrobiologia, Vol 48, No 3, p 251-255, March 31, 1976. 1 fig, 2 tab, 8 ref.

Descriptors: \*Storms, Effects, \*Submerged vegetation stage, \*Lakes, Aquatic plants, Rooted aquatic plants, Wetlands, Standing crops,



## Field 2—WATER CYCLE

### Group 2H—Lakes

Biomass, Sediments, \*New York, \*Cayuga Lake(NY).

Tropical storm Agnes produced increased suspended sediments and decreased water transparency for a sustained period during the early summer of 1972. Biomass decreased drastically for the growing season in which the storm occurred but increased to near pre-storm levels the following year. Species composition of the plant community changed compared to 1970; in 1973 shifts in spatial distribution had occurred, and the community had further changed to one highly dominated by *Myriophyllum* sp. with the virtual exclusion of some previously abundant forms, especially *Heteranthera dubia*. (Stihler-Mass) W78-12694

**IMPACT OF FLUCTUATING WATER LEVELS ON FEEDING ECOLOGY OF BREEDING BLUE-WINGED TEAL.**  
Fish and Wildlife Service, Jamestown, ND. Northern Prairie Wildlife Research Center. G. A. Swanson, and M. I. Meyer. Journal of Wildlife Management, Vol 41, No 3, p 426-433, July, 1977. 1 fig, 2 tab, 47 ref.

Descriptors: \*Blue-winged teal, \*Food abundance, \*Water levels, waterfowl, Ducks, Foods, Invertebrates, Midges, Aquatic insects, Snails, Ecology, Drawdown, Wetlands, Lakes, Broods.

As a result of low-water levels in 1973, seasonal wetlands dried early in the spring, and blue-winged teal used semi-permanent lakes that were entering a drawdown phase. When water levels fall on semi-permanent lakes, a short-term increase in invertebrate availability to waterfowl may result due to shallow water conditions and the concentration of invertebrates by a reduced water volume. Blue-winged teal shifted from a diet high in snails when seasonal wetlands were relatively abundant to one dominated by midge larvae when semi-permanent lakes were the main wetlands used. (Stihler-Mass) W78-12695

**FRESHWATER WETLANDS AND SEWAGE EFFLUENT DISPOSAL: PROCEEDINGS OF A NATIONAL SYMPOSIUM HELD AT THE UNIVERSITY OF MICHIGAN.**  
For primary bibliographic entry see Field 5E. W78-12707

**SURFACE HYDROLOGY OF PEATLANDS,**  
Michigan Univ., Ann Arbor. Dept. of Chemical Engineering. R. H. Kadlec. In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium Held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 3-24, 1976. 11 fig, 3 ref.

Descriptors: \*Hydrology, \*Michigan, Evapotranspiration, Wetlands, Waste water, Flow, Precipitation(Atmosphere), Streamflow, Hydrologic budget, \*Peatlands, \*Houghton Lake(Mich).

The hydrology of Porter Ranch at Houghton Lake, Michigan, an undisturbed peatland, is discussed. A correlation exists between precipitation and inflow with a drainage time on the order of 3 to 5 days; outflow is also responsive to rain on a short-time scale. For both inflow and outflow, magnitudes are 5 to 10 times less than either precipitation or evapotranspiration. The 15-cm litter-stem zone has a hydraulic conductivity of 92 cm/sec.; for all practical purposes, flow is zero below the peat surface. The peatland was irrigated with wastewater amounting to 8 inches on 10 acres in 8 weeks. No water level effects were observed; no increases in peatland outflow were observed. It is believed that a major portion of the added water evaporated from the test locale. (See also W78-12707) (Stihler-Mass) W78-12708

**DISSOLVED NUTRIENTS IN A PEATLAND NEAR HOUGHTON LAKE, MICHIGAN,**  
Utah State Univ., Logan. Dept. of Wildlife Science. For primary bibliographic entry see Field 5C. W78-12709

**PRODUCTIVITY AND NUTRIENT CONTENT OF EMERGENT MACROPHYTES IN TWO WISCONSIN MARSHES,**  
Wisconsin Univ.-Milwaukee. Dept. of Botany. For primary bibliographic entry see Field 5C. W78-12710

**EFFECTS OF SEWAGE EFFLUENT ON ECOSYSTEM DYNAMICS IN CYPRESS DOMES,**  
Florida Univ., Gainesville. Center for Wetlands. For primary bibliographic entry see Field 5C. W78-12714

**INSECTS AND WETLANDS,**  
Michigan Univ., Ann Arbor. School of Natural Resources. For primary bibliographic entry see Field 7B. W78-12719

**WISCONSIN LAKE LEVELS, THEIR UPS AND DOWNS,**  
Geological Survey, Madison, WI. Water Resources Div. R. P. Novitzki, and R. W. Devaul. Wisconsin University Geological and Natural History Survey, Madison, February 1978. 11 p, 5 fig, 1 tab, 7 ref.

Descriptors: \*Wisconsin, \*Lakes, \*Water level fluctuations, \*Lake stages, Inflow, Discharge(Water), Seasonal, Fluctuations, \*Hydrologic lake classification, \*Lake-aquifer relationships, \*Lake hydrology.

Lakes in Wisconsin are grouped into three major lake types—ground-water flow through, ground-water discharge, and surface-water flow through. Lake type is inferred from lake characteristics: ground-water flow-through lakes are those with neither inlet nor outlet; ground-water discharge lakes are those with only outlet streams; surface-water flow-through lakes are those with substantial inlet and outlet streams. Water-level fluctuations are greatest in the ground-water flow-through lakes, where levels ranged from 2.5 feet to nearly 11 feet during the period of record. Fluctuations are smallest in the ground-water discharge lakes, where levels ranged from 1.4 to 3.5 feet. Surface-water flow-through lakes fluctuated from 3.4 to 7.3 feet. High lake levels are typical in spring or early summer; low levels in fall or winter. High lake levels occasionally occur in winter or fall in lakes that respond to ground-water recharge after the growing season and in lakes influenced by surface runoff. The fluctuation in ungaged lakes is estimated to be within the ranges for the lake types described. (Woodard-USGS) W78-12728

**THE HYDROLOGY OF LAKE ROUSSEAU, WEST-CENTRAL FLORIDA,**  
Geological Survey, Tallahassee, FL. Water Resources Div. For primary bibliographic entry see Field 7C. W78-12741

**PHOSPHORUS SOURCE MANAGEMENT FOR EUTROPHIC LAKES. PHASE I: TRIBUTARY PHOSPHORUS LOADING,**  
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology; and Rutgers - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering. For primary bibliographic entry see Field 5B. W78-12746

**MULTISPECTRAL REMOTE OBSERVATIONS OF HYDROLOGIC FEATURES ON THE NORTH SLOPE OF ALASKA,**  
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. For primary bibliographic entry see Field 2C. W78-12832

**WIND-DRIVEN, STEADY FLOWS IN LAKE SUPERIOR,**  
National Taiwan Univ., Taipei. Inst. of Oceanography. S. L. Lien, and J. A. Hoopes. Limnology and Oceanography, Vol. 23, No. 1, p 91-103, January 1978. 12 fig, 1 tab, 22 ref.

Descriptors: \*Water circulation, \*Lake Superior, \*Winds, \*Model studies, Mathematical models, Laboratory tests, Lakes, Circulation, Currents(Water), Velocity, Analytical techniques, Flow, Energy, Bathymetry, Limnology, Wind-driven circulation, Physical models.

The wind-induced, steady-state circulations in Lake Superior were investigated by use of both mathematical and physical models. The mathematical model was developed from the equations of motion, assuming a homogeneous lake, negligible nonlinear accelerations, constant Coriolis force, hydrostatic pressure distribution, negligible horizontal turbulent shear stresses, and constant vertical eddy viscosity. With these assumptions, the equations of motion were solved analytically to give expressions for the velocities in terms of position in lake, wind stress, water surface slopes, depth, vertical eddy viscosity, and bottom condition (i.e. no-slip or slip). Water surface slopes were obtained from a numerical solution to the vertically integrated equations of motion, expressed in terms of a mass transport stream function and subject to appropriate wind stress and inflow-outflow conditions. Two- and three-dimensional velocity fields were obtained for uniform and curl wind stress distributions, for constant (average) and actual (variable) depth conditions, and for slip and no-slip on bottom. Laboratory experiments on the wind-generated circulation were conducted in a rotating, vertically distorted model of Lake Superior. Surface current patterns were obtained for steady, westerly winds that were constant in magnitude (uniform) over the lake and that had a constant curl (speeds decreased linearly from south to north) over the lake. The laboratory circulation patterns were in reasonable agreement with results from the numerical model. (Sims-ISWS) W78-12850

**MONO LAKE: SILENT, SAILLESS, SHRINKING SEA,**  
For primary bibliographic entry see Field 4A. W78-12851

**CONCENTRATIONS OF HEAVY METALS IN SMALL NORWEGIAN LAKES,**  
Norsk Inst. for Vannforskning, Blindern. For primary bibliographic entry see Field 5B. W78-12861

**EXPERIMENTAL AND FIELD STUDIES ON ECOLOGICAL ENERGETICS OF ASELLUS AQUATICUS L. (ISOPODA), III. POPULATION DYNAMICS ON THE BACKGROUND OF MACROBENTHOS OCCURRENCE IN THE LITTORAL ZONE OF POWSINSKIE LAKE,**  
Polish Academy of Sciences, Warsaw (Poland). Dept. of Ecological Bioenergetics. For primary bibliographic entry see Field 5C. W78-12865

**GROWTH OF HETEROTROPHIC BACTERIA AND ALGAL EXTRACELLULAR PRODUCTS IN OLIGOTROPHIC WATERS,**  
Montana State Univ., Bozeman. Dept. of Microbiology.

For primary bibliographic entry see Field 5C.  
W78-12886

**COMPARISON OF LIGHT AND ELECTRON MICROSCOPIC DETERMINATIONS OF THE NUMBER OF BACTERIA AND ALGAE IN LAKE WATER,**  
Lund Univ., (Sweden). Dept. of Microbiology.  
For primary bibliographic entry see Field 5A.  
W78-12888

**THE DISTRIBUTION OF NUTRIENTS IN SWARTVLEI, A SOUTHERN CAPE COASTAL LAKE,**  
Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.  
For primary bibliographic entry see Field 5B.  
W78-12889

**VERTICAL MIGRATION IN ZOOPLANKTON AS A PREDATOR AVOIDANCE MECHANISM,**  
Washington Univ., Seattle. Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W78-12891

**NITROGEN AND PHOSPHORUS INPUT TO THE MIDMAR DAM, NATAL,**  
National Inst. for Water Research, Cogella, (South Africa).  
For primary bibliographic entry see Field 5C.  
W78-12893

**NUMBERS AND BIOMASS OF THE LITTORAL FAUNA IN MIKOLAJSKIE LAKE AND IN OTHER MASURIAN LAKES,**  
Polish Academy of Science, Warsaw. Dept. of Hydrobiology.  
For primary bibliographic entry see Field 5C.  
W78-12894

**NORTH AMERICAN PROJECT--A STUDY OF U.S. WATER BODIES.**  
Corvallis Environmental Research Lab., OR.  
For primary bibliographic entry see Field 5C.  
W78-12895

**ANALYSIS OF TROPIC CONDITIONS AND EUTROPHICATION FACTORS IN LAKE WEIR, FLORIDA,**  
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12896

**AN OVERVIEW OF LIMNOLOGICAL CHARACTERISTICS OF SHAGAWA LAKE, MINNESOTA,**  
Corvallis Environmental Research Lab., OR.  
For primary bibliographic entry see Field 5C.  
W78-12897

**LAKE SALLIE, MINNESOTA,**  
North Dakota Univ., Grand Forks. Dept. of Biology.  
For primary bibliographic entry see Field 5C.  
W78-12898

**THREE OLIGOTROPHIC LAKES IN NORTHERN MINNESOTA,**  
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.  
For primary bibliographic entry see Field 5C.  
W78-12899

**PHYTOPLANKTON, PHOSPHORUS, AND SEWAGE EFFLUENTS IN LAKE MINNETONKA,**  
Minnesota Univ., St. Paul. Dept. of Ecology and Behavioral Ecology.  
For primary bibliographic entry see Field 5C.  
W78-12900

**REPORT ON THE MINNEAPOLIS CITY LAKES,**  
Minnesota Univ., Minneapolis. Limnological Research Center.  
For primary bibliographic entry see Field 5C.  
W78-12901

**A DESCRIPTION OF THE TROPIC STATUS AND NUTRIENT LOADING FOR LAKE GEORGE, NEW YORK,**  
Rensselaer Polytechnic Inst., Troy, NY. Fresh Water Inst.  
For primary bibliographic entry see Field 5C.  
W78-12902

**THE LIMNOLOGY OF CAYUGA LAKE, NEW YORK--A SUMMARY,**  
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.  
For primary bibliographic entry see Field 5C.  
W78-12903

**TROPIC STATUS AND NUTRIENT BALANCE FOR CANADARAGO LAKE,**  
New York State Dept. of Environmental Conservation, Albany.  
For primary bibliographic entry see Field 5C.  
W78-12904

**LIMNOLOGICAL AND GEOCHEMICAL CHARACTERISTICS OF THE TWIN LAKES WATERSHED, OHIO,**  
Kent State Univ., OH. Center for Urban Regionalism and Environmental Systems.  
For primary bibliographic entry see Field 5C.  
W78-12905

**WALDO LAKE, OREGON,**  
Corvallis Environmental Research Lab., OR.  
For primary bibliographic entry see Field 5C.  
W78-12906

**LAKE WASHINGTON,**  
Washington Univ., Seattle. Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W78-12907

**NUTRIENT LOADING AND TROPIC STATE OF LAKE SAMMAMISH, WASHINGTON,**  
Washington Univ., Seattle. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5C.  
W78-12908

**LAKE MENDOTA - NUTRIENT LOADS AND BIOLOGICAL RESPONSE,**  
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12909

**REPORT ON NUTRIENT LOAD - EUTROPHICATION RESPONSE OF LAKE WINGRA, WISCONSIN,**  
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12910

**REPORT ON NUTRIENT LOAD - EUTROPHICATION RESPONSE OF SELECTED SOUTHCENTRAL WISCONSIN IMPOUNDMENTS,**  
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.  
For primary bibliographic entry see Field 5C.  
W78-12911

**THE JOHN H. KERR RESERVOIR, VIRGINIA - NORTH CAROLINA,**  
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.  
For primary bibliographic entry see Field 5C.  
W78-12912

**TROPIC STATUS AND NUTRIENT LOADING FOR LAKE TAHOE, CALIFORNIA - NEVADA,**  
California Univ., Davis. Div. of Environmental Studies.  
For primary bibliographic entry see Field 5C.  
W78-12913

**REPORT ON NUTRIENT LOAD - EUTROPHICATION RESPONSE FOR THE OPEN WATERS OF LAKE MICHIGAN,**  
Texas Univ. at Dallas, Richardson. Center for Environmental Studies.  
For primary bibliographic entry see Field 5C.  
W78-12914

**TROPIC STATUS AND NUTRIENT LOADING FOR LAKE MICHIGAN,**  
Michigan Univ., Ann Arbor. Great Lakes Research Div.  
For primary bibliographic entry see Field 5C.  
W78-12915

## 21. Water In Plants

**WATER RESOURCES AND FRESHWATER FISHERIES IN SOUTHERN AFRICA,**  
Rhodes Univ., Grahamstown (South Africa).  
P. B. N. Jackson.

In: Conference on resources of Southern Africa today and tomorrow, (Johannesburg), South Africa, p 196-207, September 22-26, 1975. 5 ref.

Descriptors: \*Freshwater fish, \*Fisheries, \*Water resources, Fish farming, Eutrophication, Fish conservation, Legal aspects, Water pollution, Fishing, Fish management, Fish stocking, Fish types, Economic assessment, \*Southern Africa, South Africa, Zambia, Malawi, Botswana.

Freshwater fisheries are described in Zambia, Malawi and Rhodesia and points out how inadequate planning has all but ruined some previously rich fishing grounds, due to overfishing and the use of smaller mesh nets. The potential richness of Kariba, the Okavango swamps and Cabora Bassa as producers of freshwater fish for a hungry population is discussed and thoughts are expressed as to the preservation and management of these valuable natural resources. The reasons why Commercial freshwater fishing in South Africa has never been practiced are discussed and criticised. The importation of exotic species for angling sport are mostly to blame as authorities fear that netting would exterminate the trout and bass that have been established at great cost. The emergence of fish farming in Transvaal and Natal is discussed and the possibility of using indigenous fish like Tilapia in aquaculture for the better management of eutrophic waters is suggested. Conclusions suggest the formation of a water bank, a campaign to promote the conservation of water by irrigation farmers, a revision of the Water Act to give equal consideration to fish and wildlife as well as human water needs, the multi purpose use of storage dams and the funding of research on the fish populations of our larger dams. (So Afr Water Info Ctr)  
W78-12419

## Field 2—WATER CYCLE

### Group 21—Water in Plants

**COMMUNITY STRUCTURE, DYNAMICS AND NUTRIENT CYCLING IN THE OKEFENOKEE CYPRESS SWAMP-FOREST,**  
California Univ., Santa Barbara. Dept. of Biological Sciences.

W. H. Schlesinger.  
Ecological Monographs, Vol. 48, p 43-65, Winter, 1978. 3 fig, 13 tab, 120 ref.

Descriptors: \*Communities, \*Nutrients, \*Cycling nutrients, Biomass, Productivity, Forests, Swamps, Bogs, \*Cypress, Okefenokee Swamp, Biogeochemistry, Peat, Georgia.

Dominance of the tree stratum by cypress is probably due to recurrent understory fires which eliminate other swamp species. Density and total basal area of living stems greater than 4 cm diameter vary greatly, but mean values (1,465 stems/ha; 52 sq m/ha) are high compared to upland forests. Differences in density among stands are due to past differences in the frequency and intensity of forest fires during periodic droughts. Cypress trees compose 98% of the total forest above-water biomass of 307 tonnes/ha. Net primary productivity is low (692 g/sq m/yr); high biomass is the result of the old age (150 yr) of the stand and the high density of trees. Cypress net production is largely channeled into bole wood (41%) and current twigs with needles (41 %). Nutrient pools in the above water community are large (666 kg/ha Ca, 111 kg/ha Mg, 230 kg/ha K, 996 kg/ha N and 46 kg/ha P) and primarily contained in cypress boles. The nutrient uptake (54 kg/ha/yr, 11 each for Mg and K and 2.3 for P) is largely channeled to the small amount (231 g/sq m) of very efficient cypress foliage abscission and foliar leaching by rainfall return 73 to 91% of the annual nutrient uptakes. Except for K which is apparently resorbed from foliage before abscission, the cypress trees do not appear to conserve foliar nutrients. Nutrient conservation may be effected by minimizing the amount of foliage. Litterfall has resulted in a large accumulation of peat containing permanent nutrient losses from the community. (Maroncelli-Mass)

W78-12679

**ELM-ASH-COTTONWOOD FOREST TYPE BIBLIOGRAPHY,**  
Purdue Univ., Lafayette, IN. Dept. of Forestry and Natural Resources.  
S. R. Shiffley, and K. M. Brown.  
USDA Forest Service, North Central Forest Experiment Station, General Technical Report NC-42, 1978. 56 p, 2 ref.

Descriptors: \*Bibliographies, \*Ash trees, \*Cottonwoods, Wetlands, Forests, Deciduous trees, Maple trees, Forest management, Ecology, Trees, Elm trees.

The 679 references on the biology, ecology, silviculture and mensuration of the elm-ash-cottonwood type, characteristic of many wooded wetlands of the southeastern United States, are arranged by author's names, species, and subject index is provided. (Stihler-Mass)

W78-12681

**SEED VIABILITY IN SALT MARSH TAXA, GEORGETOWN COUNTY, SOUTH CAROLINA,**  
Saint John's Univ., Jamaica, NY. Dept. of Biology.  
For primary bibliographic entry see Field 2L.

W78-12683

**SEED VIABILITY IN TWO ATLANTIC COAST POPULATIONS OF SPARTINA ALTER-NIFLORA,**  
Saint John's Univ., Jamaica, NY. Dept. of Biology.  
For primary bibliographic entry see Field 2L.

W78-12684

**ORIGIN OF BLANKET MIRES,**  
King's Coll., London (England). Dept. of Plant Sciences.  
For primary bibliographic entry see Field 4C.

W78-12685

**THE INFLUENCE OF FLOATING VASCULAR PLANTS ON THE DIURNAL FLUCTUATIONS OF TEMPERATURE NEAR THE WATER SURFACE IN EARLY SPRING,**  
Guelph Univ. (Ontario). Dept. of Botany and Genetics.  
H. M. Dale, and T. Gillespie.  
Hydrobiologia, Vol 49, No 3, p 245-256, June 30, 1976. 4 fig, 6 tab, 20 ref.

Descriptors: \*Floating plants, \*Water temperature, Effects, \*Diurnal, Winds, Aquatic plants, Energy, Wetlands, Temperature, Air temperature, Heat transfer, Spring, Duckweed, Ponds.

On clear days a mat of duckweed or other floating aquatic plants increased the temperature at the water surface from 4.0 to 11.0 degrees C. above that of adjacent open water. The temperature of the environment 2 cm above or below the plant surface closely followed the surface temperature's quick response to changes in net radiation. The plant surface reflects more and transmits less energy than open water, therefore there is less fluctuation in temperature in the water 10 cm and more below the floating plant surface. This results in a diurnal thermal stratification below the mat. At the surface of the open water changes in temperature tended to be smaller and slower, and, with wind disturbance, the water profile maintained relatively homogeneous temperatures. (Stihler-Mass)

W78-12688

**REMOTE SENSING FOR IDENTIFICATION AND CLASSIFICATION OF WETLAND VEGETATION,**  
Fisheries and Wildlife, Jamestown ND. Northern Prairie Wildlife Research Center.  
L. M. Cowardin, and V. I. Myers.  
Journal of Wildlife Management, Vol 38, No 2, p 308-314, April, 1974. 1 fig, 3 tab, 24 ref.

Descriptors: \*Remote sensing, \*Wetlands, \*Vegetation, \*Infrared radiation, Aquatic plants, Lakes, Swamps, \*Minnesota, Wild rice, Floating plants, Aerial photography, Multispectral photography.

Multispectral photography and ground truth were obtained on an area of 12 miles (19.3 km) east of Bemidji, Minnesota, to identify and map wetlands less than 2 acres (0.8 hectare) in size, to map emergent vegetation in lakes, and to explore the feasibility of classifying vegetation from aerial photographs. Wetlands less than 2 acres in size were identified on photography taken in May 1971, and emergent vegetation was recorded on purposely overexposed infrared black and white photography from a flight in September 1971. Several vegetation types and species groups were recognizable with the aid of color, color infrared, and black and white infrared photography. Proper timing of flights, use of multispectral photography, and knowledge of the ecology of the area are considered essential for wetland mapping by remote sensing. (Stihler-Mass)

W78-12689

**VARIABILITY OF WETLAND REFLECTANCE AND ITS EFFECT ON AUTOMATIC CATEGORIZATION OF SATELLITE IMAGERY,**  
Delaware Univ., Newark. Center for Remote Sensing.  
For primary bibliographic entry see Field 7B.

W78-12690

**SEDIMENTATION RATES, SHORELINE MODIFICATION, AND VEGETATION CHANGES ON TIDAL MARSHES ALONG THE COAST OF CONNECTICUT,**  
Cornell Univ., Ithaca, NY.  
For primary bibliographic entry see Field 2L.

W78-12691

**WATERFOWL USE OF UTAH MOUNTAIN WETLANDS IN UTAH,**  
Utah Cooperative Wildlife Research Unit, Logan. S. R. Peterson, and J. B. Low.  
Journal of Wildlife Management, Vol 41, No 1, p 112-117, January, 1977. 2 fig, 3 tab, 8 ref.

Descriptors: \*Wetlands, \*Waterfowl, \*Utah, \*Elevation, Ducks, Mallard ducks, Rooted aquatic plants, Invertebrates, Reproduction, Broods, Ponds, Freezing.

Waterfowl use was recorded in 1965 and 1966 at different evaluations from spring thaw until fall freeze-up. Sixteen species were observed; mallard, green-winged teal, pintail, and ring-necked duck were the most abundant species. Ninety-eight percent of the observed waterfowl were below 3,000 m. Adult waterfowl were seen most often on natural catchment basins and beaver ponds larger than 0.4 ha. Low-elevation wetlands (< 2,000 m) had high indices of aquatic invertebrates and contained aquatic plants with high seed-producing capabilities, whereas high-elevation wetlands (> 2,900 m) had little waterfowl food. Utilization of high mountain wetlands by spring migrants and breeders was dependent upon ice melt, whereas freeze-up did not seriously affect fall use. (Stihler-Mass)

W78-12693

**CHANGES IN SUBMERGED PLANTS AT THE SOUTH END OF CAYUGA LAKE FOLLOWING TROPICAL STORM AGNES,**  
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.  
For primary bibliographic entry see Field 2H.

W78-12694

**IMPACT OF FLUCTUATING WATER LEVELS ON FEEDING ECOLOGY OF BREEDING BLUE-WINGED TEAL,**  
Fish and Wildlife Service, Jamestown, ND. Northern Prairie Wildlife Research Center.  
For primary bibliographic entry see Field 2H.

W78-12695

**1974 FINAL REPORT, RESEARCH ON SHORE AND UPLAND MIGRATORY BIRDS IN NEW JERSEY CLAPPER RAIL STUDIES,**  
New Jersey Dept. of Environmental Protection, Trenton. Div. of Fish, Game, and Shellfisheries.  
R. E. Mangold.  
1974. 17 p, 3 fig, 10 tab, 7 ref.

Descriptors: \*Rails, \*Distribution patterns, \*Census, \*New Jersey, Wetlands, Salt marshes, Birds, Wading birds, Marshes, Migratory birds, Spatial distribution, Temporal distribution, Nesting, Clapper rail, Call counts.

The principal goals of the project were an ecological study of the clapper rail, a common salt marsh bird, and to develop a technique to determine population status on a state-wide basis. The one technique usable on as large an area as a state was the use of call counts on the various marsh types. This system is a relatively inexpensive, yet fairly accurate index of annual changes in the abundance of the clapper rail. (Steiner-Mass)

W78-12696

**THE MARSHES OF MISSISSIPPI,**  
Gulf Coast Research Lab., Ocean Springs, MS.  
For primary bibliographic entry see Field 2L.

W78-12697



**THE DISTRIBUTION OF CERTAIN SUBMERGED PLANTS IN MISSISSIPPI SOUND AND ADJACENT WATERS,**  
Gulf Coast Research Lab., Ocean Springs, MS.  
L. N. Eleuterius.  
In: Cooperative Gulf of Mexico Estuarine Inventory and Study, Mississippi, p 191-197, 1973. 2 fig, 1 tab, 24 ref.

Descriptors: \*Mississippi, \*Estuarine environments, \*Submerged plants, Estuaries, Distribution patterns, Rooted aquatic plants, Algae, Substrate, Salinity.

A systematic sampling program was set up to locate, record, and map the extent of seagrass beds, submerged spermatophytes, and attached algae of Mississippi Sound. A more diversified plant community was found in the eastern portion and unique stands of benthic algae were present in the western portion. Some obvious factors responsible for the presence of the attached submerged vegetation are substrate, water depth, salinity, and protection from erosion. No plant habitats were found off the beaches exposed to the open Gulf. A succession was noticed in the composition of the algal species present in pure stands and associated with the spermatophytes. Substratum is a limiting factor for plant growth and distribution in Mississippi waters. The diversity of marine species which now occurs is mainly because of minor alterations of the environment by man. (See also W78-12698) (Steiner-Mass)  
W78-12703

**ESTUARINE ZOOPLANKTON, MISSISSIPPI,**  
Gulf Coast Research Lab., Ocean Springs, MS.  
For primary bibliographic entry see Field 2L.  
W78-12704

**ESTUARINE INVERTEBRATES, MISSISSIPPI,**  
Gulf Coast Research Lab., Ocean Springs, MS.  
J. Y. Christman, and W. Langley.  
In: Cooperative Gulf of Mexico Estuarine Inventory and Study, p 255-319, 1973. 2 fig, 32 tab, 96 ref.

Descriptors: \*Mississippi, \*Estuarine environment, \*Invertebrates, Estuaries, Distribution patterns, Crustaceans, Aquatic animals, Mollusks, Shellfish, Shrimp.

The occurrence, relative abundance, seasonal and areal distribution of invertebrates within the temperature-salinity matrix in the Mississippi estuarine study area are reported. A total of 180 species in 124 families are listed. Sediment samples included 62 species in 43 families that were not collected in trawls and seines. Thirty species of crustaceans and mollusks comprised 97% of the total number of specimens taken by trawl and seine. Polychaetes and mollusks dominated the infauna. White and brown shrimp were the two most abundant species. Shrimp, crabs, and oysters provided all of the reported commercial landings of invertebrate species. Squid was the fourth most abundant species. (See also W78-12698) (Steiner-Mass)  
W78-12705

**ESTUARINE VERTEBRATES, MISSISSIPPI,**  
Gulf Coast Research Lab., Ocean Springs, MS.  
For primary bibliographic entry see Field 2L.  
W78-12706

**INSECTS AND WETLANDS,**  
Michigan Univ., Ann Arbor. School of Natural Resources.  
For primary bibliographic entry see Field 7B.  
W78-12719

**RESISTANCE TO WATER UPTAKE IN A DOUGLAS FIR FOREST,**  
British Columbia Univ., Vancouver. Dept. of Soil Science.  
J. U. Nnyamah, T. A. Black, and C. S. Tan.  
Soil Science, Vol 126, No 2, p 63-76, August 1978. 10 fig, 2 tab, 36 ref.

Descriptors: \*Douglas fir trees, \*Moisture uptake, \*Resistance, Soils, Forests, Soil water, Drying, Roots, Xylem, Evapotranspiration, Trees, Forestry, Forest soils, On-site investigations, Model studies, Mathematical models, Soil science, Water uptake.

Soil and root resistances were studied in two stands of a Douglas fir forest. Soil water potential was measured with a tensiometer-pressure transducer system in the 0 to -1-bar range, and with Wescor HR-33T dew point microvoltmeter and hygrometers at values less than -1 bar. Root xylem water potential was measured with hygrometers, and twig xylem pressure potential was measured by the pressure-chamber technique. Transpiration rates were calculated from energy balance and stomatal diffusion resistance measurements. Total bulk-soil-to-root xylem resistances were calculated from the water potential differences and transpiration fluxes. Root density was determined from intensive sampling. Root xylem water potential, like twig xylem pressure potential, showed a definite diurnal trend. Soil water potential approached the root water potential as the soil dried. Assuming the absence of contact resistance between roots and soil, the soil water potential of -11 bars. An analysis using a contact resistance model suggested that contact resistance could account for one-half the total bulk-soil-to-root-xylem resistance when the soil was moist (-0.3 bar) and almost three-quarters when dry (-11 bars). Analysis of midday data during the drying period showed that the rate of water uptake was linearly related to the difference between soil and root xylem water potentials, and that total soil-to-root-xylem resistance remained relatively constant with decreasing soil water potential. (Sims-ISWS)  
W78-12840

**PLUTONIUM UPTAKE BY PLANTS FROM SOIL CONTAINING PLUTONIUM-238 DIOXIDE PARTICLES,**  
Environmental Monitoring and Support Lab., Las Vegas, NV.  
For primary bibliographic entry see Field 5B.  
W78-12938

**GROWTH OF RUSSIAN ELM AND EUROPEAN ASH SEEDLINGS DEPENDING ON DURATION OF FLOODING (IN BELORUSSIAN),**  
Akademiya Navuk BSSR, Minsk. Inst. of Experimental Botany.  
M. D. Nyestysarovich, and T. F. Dzyaruhina.  
Vyestsi Akad Navuk Bssr Biyal Navuk 4, p 5-9, 1975.

Descriptors: \*Ash, \*Elm, European ash, \*Flooding, Growth rates, Root, Seedlings, Shoots, Trunks, Russian elm, Trees.

The effect of flooding for 15,30,60,90, and 120 days on the growth of Russian elm and European ash seedlings was investigated. In the initial period flooding had no effect on plant development. Shoot growth began simultaneously in the control and flooded variants. Flooding for up to 60 days had little effect on the duration of shoot growth (82-88 days for elm and 67 days for ash). However, in this case there was a decrease in the average indices of the shoot length (78.8% for elm and 55.5% for ash in comparison with the control), plant height (by 21.1% for elm and 10.6% for ash), diameter of the trunks and root length. An increase of the flooding time to 90 and 120 days shortened the growth period of the shoots by 30-36 days for elm and 35 days for ash. Under these conditions the shoot length, trunk diameter, root length and

plant height decreased even more in comparison with the control.  
W78-12987

## 2J. Erosion and Sedimentation

**ANALYSIS FOR POLYCHLORINATED BIPHENYLS IN LAKE MACATAWA BOTTOM SEDIMENTS,**  
Hope Coll., Holland, MI. Dept. of Chemistry.  
For primary bibliographic entry see Field 5A.  
W78-12105

**FLUID DYNAMIC LIFT ON A BED PARTICLE,**  
Canterbury Univ., Christchurch (New Zealand). Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 8B.  
W78-12138

**A SEDIMENT GRAPH MODEL BASED ON AN INSTANTANEOUS UNIT SEDIMENT GRAPH,**  
Agricultural Research Service, Temple, TX. Grassland Forage Research Center.  
For primary bibliographic entry see Field 4D.  
W78-12145

**DEVELOPMENT OF A SIMPLE, RAPID FIELD TECHNIQUE FOR ESTIMATING OIL CONCENTRATIONS IN THE SEDIMENTS,**  
Mississippi State Univ., Mississippi State.  
For primary bibliographic entry see Field 5A.  
W78-12182

**AN EXPERIMENTAL INVESTIGATION OF SOME COMBINED FLOW SEDIMENT TRANSPORT PHENOMENA,**  
North Carolina State Univ. at Raleigh. Center for Marine and Coastal Studies.  
For primary bibliographic entry see Field 2L.  
W78-12188

**SEDIMENT DISPERSAL TRENDS OF THE CAMINADA-MOREAU BEACH-RIDGE SYSTEM,**  
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.  
For primary bibliographic entry see Field 2L.  
W78-12193

**EVALUATION OF LYOPHILIZATION METHOD OF DISAGGREGATING SAND, SILT AND CLAY,**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
For primary bibliographic entry see Field 2G.  
W78-12258

**PHOSPHORUS INTERACTIONS WITH STREAM-BED SEDIMENTS,**  
South Dakota School of Mines and Technology, Rapid City. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5B.  
W78-12280

**INVESTIGATION ON DRILLING CORES OF SEDIMENTS OF LAKE CONSTANCE: I. PROFILES OF THE POLYCYCLIC AROMATIC HYDROCARBONS (IN GERMAN),**  
Biochemisches Inst. Umweltcarcinogene, Ahrensburg (West Germany).  
For primary bibliographic entry see Field 5A.  
W78-12290

**DECISIONS FOR DELAWARE: SEA GRANT LOOKS AT BEACH MANAGEMENT,**  
Delaware Univ., Newark. Coll. of Marine Studies.  
For primary bibliographic entry see Field 2L.  
W78-12312



## Field 2—WATER CYCLE

### Group 2J—Erosion and Sedimentation

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 3: MILWAUKEE COUNTY.** Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison.

D. M. Mickelson, R. Klauk, L. Acomb, T. Edil, and B. Haas. Wisconsin Coastal Management Technical Report, 'Shore Erosion Study', Appendix 3, February 1977. 118 p.

Descriptors: \*Lake Michigan, \*Erosion, \*Shores, Wisconsin, Geomorphology, Lakeshores, Coastal zone management.

Detailed information on shoreline conditions within much of Milwaukee County is presented. A text which describes the characteristics of shoreline conditions at the beginning of each reach section is accompanied by a map of the whole reach which shows the sections, public perception of erosion hazards, shore damage in 1952, short- and long-term recession rates, bluff height, shore protection structures, houses per mile, and boat ramps. Also on the map, locations of measured profiles are shown along the shoreline. A running description of bluff characteristics, materials making up the toe of the slope, and beach characteristics are also given. Engineering data such as safety factor, the confidence level on this safety factor, and the distance the slope must retreat to attain a stable slope angle is given. It should be noted that this distance assumes no wave cutting at the base of the bluff. Profiles from the water's edge to the bluff top are included with each section. These profiles show stratigraphy, slope angles, circles of failure, and calculated safety factors along the shoreline. (NOAA) W78-12314

**BEACH PROFILES OBTAINED WITH AN AMPHIBIOUS DUKW ON THE OREGON AND WASHINGTON COASTS.** Oregon State Univ., Corvallis. Dept. of Oceanography. For primary bibliographic entry see Field 2L. W78-12317

**THE ANNUAL CYCLE OF PROFILE CHANGES OF TWO OREGON BEACHES.** Oregon State Univ., Corvallis. School of Oceanography. For primary bibliographic entry see Field 2L. W78-12318

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN.** Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison. D. M. Mickelson, L. Acomb, N. Brouwer, T. Edil, and C. Fricke. Wisconsin Coastal Management Technical Report, 'Shore Erosion Study', February 1977. 209 p, 94 fig, 4 tab, 22 ref.

Descriptors: \*Wisconsin, \*Lake Michigan, \*Lake Superior, \*Erosion, \*Shores, Geomorphology, Lakeshores, Coastal Zone Management.

Shoreline erosion is a critical problem along Wisconsin's Lake Michigan and Lake Superior Coasts. The Shore Erosion Study forms an integral part of the Coastal Management Development Program with a primary goal of developing alternative plans for the prevention and abatement of shore damage to private and public coastal property. The Shore Erosion Study is divided into three major elements: (1) the analysis of protective

structural alternatives, (2) the analysis of non-structural alternatives, (3) the field survey of erosion problem areas. This report represents the field survey effort and is based directly on many of the preceding work elements of the study, and forms the essential basis for the analyses of structural and non-structural alternatives. (NOAA) W78-12336

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 1: KENOSHA COUNTY.** Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison. A. F. Schneider, T. Edil, and B. Haas. Wisconsin Coastal Management Technical Report, 'Shore Erosion Study', Appendix 1, February 1977. 82 p.

Descriptors: \*Lake Michigan, \*Erosion, \*Shores, Wisconsin, Geomorphology, Lakeshores, Coastal Zone Management.

Detailed information on shoreline conditions within much of Kenosha County is presented. A text which describes the characteristics of shoreline conditions at the beginning of each reach section is accompanied by a map of the whole reach which shows the sections, public perception of erosion hazards, shore damage in 1952, short- and long-term recession rates, bluff height, shore protection structures, houses per mile, and boat ramps. Also on the map, locations of measured profiles are shown along the shoreline. A running description of bluff characteristics, materials making up the toe of the slope, and beach characteristics are also given. Engineering data such as safety factor, the confidence level on this safety factor, and the distance the slope must retreat to attain a stable slope angle is given. It should be noted that this distance assumes no wave cutting at the base of the bluff. These profiles from the water's edge to the bluff top are included with each section. These profiles show stratigraphy, slope angles, circles of failure, and calculated safety factors along the shoreline. (NOAA) W78-12337

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 8: MILWAUKEE COUNTY, SUMMARY OF ENGINEERING BORING LOGS.** Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison. R. Klauk. Wisconsin Coastal Management Technical Report, 'Shore Erosion Study', Appendix 8, February 1977. 95 p.

Descriptors: \*Lake Michigan, \*Erosion, \*Shores, Wisconsin, Geomorphology, Boring, Lakeshores, Coastal Zone Management.

A compilation of test boring information collected in Milwaukee County between June 1, 1976 and November 1, 1976 is presented. The purpose of this section is to aid in the evaluation of the stratigraphy of the lake bluffs, to include any information that will be of value in the geotechnical evaluation of bluff stability, and to compile information that has been located with various organizations within the county. This section is organized in such a way that the borings are in succession from north to south. Included with each boring is the name of the company that did the boring, the project the boring was taken for, a location map with respect to the county, and where possible, the boring locations on the site itself. (NOAA) W78-12338

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 6: SOUTHERN AND CENTRAL MANITOWOC COUNTY.** Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison. D. Hadley, C. Fricke, T. Edil, and B. Haas. Wisconsin Coastal Management Technical Report, 'Shore Erosion Study', Appendix 6, April 1977. 98 p.

Descriptors: \*Lake Michigan, \*Erosion, \*Shores, Wisconsin, Geomorphology, Lakeshores, Coastal zone management.

Detailed information on shoreline conditions within much of southern and central Manitowoc County is presented. A text which describes the characteristics of shoreline conditions at the beginning of each reach section is accompanied by a map of the whole reach which shows the sections, public perception of erosion hazards, shore damage in 1952, short- and long-term recession rates, bluff height, shore protection structures, houses per mile, and boat ramps. Also on the map, locations of measured profiles are shown along the shoreline. A running description of bluff characteristics, materials making up the toe of the slope, and beach characteristics are also given. Engineering data such as safety factor, the confidence level on this safety factor, and the distance the slope must retreat to attain a stable slope angle is given. It should be noted that this distance assumes no wave cutting at the base of the bluff. Profiles from the water's edge to the bluff top are included with each section. These profiles show stratigraphy, slope angles, circles of failure, and calculated safety factors along the shoreline. (NOAA) W78-12360

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 5: SHEBOYGAN COUNTY.** Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison. D. Hadley, C. Fricke, T. Edil, and B. Haas. Wisconsin Coastal Management Technical Report, 'Shore Erosion Study', Appendix 5, April 1977. 119 p.

Descriptors: \*Lake Michigan, \*Erosion, \*Shores, Wisconsin, Geomorphology, Lakeshores, Coastal Zone Management.

Detailed information on shoreline conditions within much of Sheboygan County is presented. A text which describes the characteristics of shoreline conditions at the beginning of each reach section is accompanied by a map of the whole reach which shows the sections, public perception of erosion hazards, shore damage in 1952, short- and long-term recession rates, bluff height, shore protection structures, houses per mile, and boat ramps. Also on the map, locations of measured profiles are shown along the shoreline. A running description of bluff characteristics, materials making up the toe of the slope, and beach characteristics are also given. Engineering data such as safety factor, the confidence level on this safety factor, and the distance the slope must retreat to attain a stable slope angle is given. It should be noted that this distance assumes no wave cutting at the base of the bluff. Profiles from the water's edge to the bluff top are included with each section. These profiles show stratigraphy, slope angles, circles of failure, and calculated safety factors along the shoreline. (NOAA) W78-12367

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 4: OZAUKEE COUNTY.** Wisconsin Geological and Natural History Survey, Madison; Wisconsin Dept. of Natural Resources, Madison; and Wisconsin Office of State Planning and Energy, Madison. L. Acomb, R. Klauk, D. Michelson, T. Edil, and B. Haas. Wisconsin Coastal Management Technical Report, 'Shore Erosion Study', Appendix 4, February 1977. 167 p.

Descriptors: \*Lake Michigan, \*Erosion, \*Shores, Wisconsin, Geomorphology, Lakeshores, Coastal Zone Management.

Detailed information on shoreline conditions within much of Ozaukee County is presented. A text which describes the characteristics of shoreline conditions at the beginning of each reach section is accompanied by a map of the whole reach which shows the sections, public perception of erosion hazards, shore damage in 1952, short- and long-term recession rates, bluff height, shore protection structures, houses per mile, and boat ramps. Also on the map, locations of measured profiles are shown along the shoreline. A running description of bluff characteristics, materials making up the toe of the slope, and beach characteristics are also given. Engineering data such as safety factor, the confidence level on this safety factor, and the distance the slope must retreat to attain a stable slope angle is given. It should be noted that this distance assumes no wave cutting at the base of the bluff. Profiles from the water's edge to the bluff top are included with each section. These profiles show stratigraphy, slope angles, circles of failure, and calculated safety factors along the shoreline. (NOAA) W78-12392

**SHORE EROSION STUDY TECHNICAL REPORT. SHORELINE EROSION AND BLUFF STABILITY ALONG LAKE MICHIGAN AND LAKE SUPERIOR SHORELINES OF WISCONSIN. APPENDIX 2: RACINE COUNTY.** Wisconsin Geological and Natural History Survey, Madison; and Wisconsin Dept. of Natural Resources, Madison. A. F. Schneider, T. Edil, and B. Haas. Wisconsin Coastal Management Technical Report, 'Shore Erosion Study', Appendix 2, February 1977. 72 p.

Descriptors: \*Lake Michigan, \*Erosion, \*Shores, Wisconsin, Geomorphology, Lakeshores, Coastal Zone Management.

Detailed information on shoreline conditions within much of Racine County is presented. A text which describes the characteristics of shoreline conditions at the beginning of each reach section is accompanied by a map of the whole reach which shows the sections, public perception of erosion hazards, shore damage in 1952, short- and long-term recession rates, bluff height, shore protection structures, houses per mile, and boat ramps. Also on the map, locations of measured profiles are shown along the shoreline. A running description of bluff characteristics, materials making up the toe of the slope, and beach characteristics are also given. Engineering data such as safety factor, the confidence level on this safety factor, and the distance the slope must retreat to attain a stable slope angle is given. It should be noted that this distance assumes no wave cutting at the base of the bluff. Profiles from the water's edge to the bluff top are included with each section. These profiles show stratigraphy, slope angles, circles of failure, and calculated safety factors along the shoreline. (NOAA) W78-12461

**STUDIES ON FUNCTION OF WATER AND SOIL CONSERVATION BASED ON FOREST LAND: II. INFLUENCE OF DISTURBANCE IN GROUND FLOOR UPON WATER RUNOFF, INFILTRATION AND SOIL EROSION, AND THE CONSERVATION MANAGEMENT OF FOREST LAND (IN JAPANESE).** Government Forest Experiment Station, Tokyo (Japan). For primary bibliographic entry see Field 4C. W78-12463

**THE DISTRIBUTION OF NUTRIENTS IN SWARTYVLEI, A SOUTHERN CAPE COASTAL LAKE.** Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies. For primary bibliographic entry see Field 5B. W78-12493

**EFFECT OF PH ON THE ADSORPTION OF TRACE RADIOACTIVE CESIUM BY SEDIMENTS.** King Faisal Univ., Dammam (Saudi Arabia). Dept. of Soils and Water, and Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy. For primary bibliographic entry see Field 5B. W78-12635

**DISSOLVED SILICA IN PORE WATERS OF LAKES ONTARIO, ERIE, AND SUPERIOR SEDIMENTS.** Canada Centre for Inland Waters, Burlington (Ontario). J. O. Nriagu. Limnology and Oceanography, Vol. 23, No. 1, p. 53-67, January 1978. 7 fig, 9 tab, 50 ref.

Descriptors: \*Silica, \*Silicates, \*Sediments, \*Great Lakes, \*Lake Ontario, \*Lake Erie, \*Lake Superior, Dissolved solids, Chemicals, Sampling, Chemical analysis, Pore water, Clays, Iron, Aluminum, Water chemistry, Diatoms, Biodegradation, Limnology, Ferroaluminum silicates.

The distribution of dissolved silica in pore waters from Lakes Ontario, Erie, and Superior sediments is not directly related to the deposition of diatoms from the overlying water. It was proposed that silica concentrations in the pore waters are controlled by dissolution of ferroaluminum silicate. The cryptocrystalline complex is formed in the sediments by the reaction of biogenic silica with aluminum and ferric oxyhydroxides or by the hydrolysis of clay minerals. A massive episodic flux of biogenic silica to the sediments follows the crash of diatom blooms. However, most of the biogenic silica is dissolved in the water column or at the sediment-water interface; a small fraction is fixed permanently in the sediments as the cryptocrystalline complex. Budget calculations showed that regeneration of silica from Ontario and Erie sediments far exceeds annual input from external sources. (Sims-ISWS) W78-12645

**SEDIMENTATION RATES, SHORELINE MODIFICATION, AND VEGETATION CHANGES ON TIDAL MARSHES ALONG THE COAST OF CONNECTICUT.** Cornell Univ., Ithaca, NY. For primary bibliographic entry see Field 2L. W78-12691

**SEDIMENT TRANSPORT IN THE FEATHER RIVER, LAKE OROVILLE TO YUBA CITY, CALIFORNIA.** Geological Survey, Menlo Park, CA. Water Resources Div. G. Porterfield, R. D. Busch, and A. O. Waananen. Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 290. Price codes: A05 in paper copy, A01 in microfiche.

Water-Resources Investigations 78-20, June 1978. 73 p, 27 fig, 14 tab, 30 ref.

Descriptors: \*Sediment transport, \*Sediment yield, \*Particle size, \*Reservoir releases, \*Streamflow, Flow rates, Data collections, \*California, \*Feather River, \*Lake Oroville (Calif), Yuba City (Calif).

Regulation of the Feather River by Oroville Dam and reservoir in northeast California (beginning in 1967) changed the streamflow and sediment discharge downstream from the dam. Changes in channel geometry to adjust to the new regimen were still in process in 1975. Streamflow and sediment concentration and discharge had decreased. Median streamflow at Feather River near Gridley and Feather River at Yuba City, 27 miles and 49 miles downstream from the dam, had not changed, although the frequency of flow rates less than median increased and the frequency of flow rates greater than median, and which transport most sediment, decreased. Sediment-transport data indicate an increase in sediment yield from the 1965-67 period to the 1968-75 period in the basin downstream from Gridley to Yuba City, although the quantity of sediment transported was reduced owing to removal of sediment by Oroville Dam and to reduced streamflow. The increase in yield, assuming no change in tributary inflow, may be attributed partly to channel erosion accelerated by the clear-water releases and to the change in frequency and magnitude of flow rates. (Woodard-USGS) W78-12736

**SUSPENDED SEDIMENT DYNAMICS IN BLUE FJORD, WESTERN PRINCE WILLIAM SOUND, ALASKA.** Alaska Univ., College. Inst. of Marine Science. For primary bibliographic entry see Field 2L. W78-12835

**EVALUATION OF THE SIGNIFICANCE OF WATERWAY SEDIMENT-ASSOCIATED CONTAMINANTS ON WATER QUALITY AT THE DREDGED MATERIAL DISPOSAL SITE.** Texas Univ. at Dallas, Richardson. For primary bibliographic entry see Field 5A. W78-12981

## 2K. Chemical Processes

**CARBON CONTENTS AND SOURCES IN GROUND WATERS OF THE CENTRAL PLATTE REGION IN NEBRASKA.** Nebraska Univ., Lincoln. Conservation and Survey Div. For primary bibliographic entry see Field 5A. W78-12103

**A STUDY OF THE KALAMOS SPRINGS IN GREECE WITH ENVIRONMENTAL ISOTOPES.** International Atomic Energy Agency, Vienna (Austria). For primary bibliographic entry see Field 2F. W78-12144

**SULFUR ISOTOPE DISTRIBUTION IN SULFATES FROM SURFACE WATERS FROM THE NORTHERN JORDAN VALLEY, ISRAEL.** Weizmann Inst. of Science, Rehovot (Israel). Dept. of Isotope Research. For primary bibliographic entry see Field 5B. W78-12167

**NUCLEAR TECHNIQUES APPLICABLE TO STUDIES OF POLLUTANTS IN GROUND WATER.** Battelle Pacific Northwest Labs., Richland, WA. For primary bibliographic entry see Field 5A.

## Field 2—WATER CYCLE

### Group 2K—Chemical Processes

W78-12168

**GEOCHEMISTRY AND HYDROTHERMAL ALTERATION AT SELECTED UTAH HOT SPRINGS. VOLUME 3.**  
Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.  
W. T. Parry, N. L. Benson, and C. D. Miller.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 415. Price codes: A08 in paper copy, A01 in microfiche. Report No. NSF/RA-760370, July 1976. 137 p., 43 fig., 18 tab., 39 ref. GI-43741.

**Descriptors:** \*Utah, \*Geochemistry, \*Heat transfer, \*Hydrothermal studies, Hot springs, Rock mechanics, Flow, Properties, Geothermal studies, Physical properties, Chemical analysis, Trace elements, Water chemistry, Thermal properties, Reservoirs, Resources, Water analysis.

This report detailed the results of estimation of subsurface temperatures in Utah from published water analyses and new analyses of selected hot springs. Two hot spring areas in differing geological environments were selected for detailed rock alteration studies. The Monroe-Red Hill area is within an area of Tertiary volcanics and is underlain by a thick Jurassic salt bearing deposit. The Roosevelt area is in Tertiary and Precambrian crystalline rocks. Comparison of rock alteration and water chemistry in these two areas serves as a model for further exploration and resource characterization in Utah using geochemical techniques. Hydrothermal alteration, heavy metal distribution and water chemistry provide some characterization of the Roosevelt system. The hot spring deposits consist of laminated opal and siliceous sinter. Geology and alteration have been mapped in the Monroe KGRA. Alteration of the volcanic host rocks includes the following assemblages: kaolinite and jarosite, kaolinite and mixed layer clay, montmorillonite and mixed layer clay, montmorillonite and chlorite. Calcite and gypsum are also abundant. (Henley-ISWS)  
W78-12171

**DETERMINATION OF CADMIUM IN WATERS OF THE STATE OF PIAUI, BRAZIL (DETERMINACAO DE CADMIO EM AGUAS DO ESTADO DO PIAUI, BRASIL).**  
Ceara Univ., Fortaleza (Brazil). Centro de Ciencias.  
J. Campos Accioly, and M. F. Santana Neves.  
Ciencia Agronomica, Vol 6, No 1-2, p 1-2, December, 1976. 1 tab, 7 ref.

**Descriptors:** \*Water analysis, \*Chemical analysis, \*Spectrophotometry, \*Cadmium, \*Brazil, Water wells, Pollutant identification, Analytical techniques, Arid lands.

Water from 37 wells in the state of Piaui, located in Brazil's arid Northeast, was tested for the presence of cadmium using atomic-absorption spectrophotometry. Concentrations varied from 1 to 5 micrograms per liter, with the exception of one sample which contained 23 micrograms per liter. After excluding that sample, the average value was 2.2 micrograms per liter - well below the maximum level for potable water (10 micrograms per liter) established by the World Health Organization. (Russell-Arizona)  
W78-12213

**DETERMINATION OF IRON, MANGANESE, COPPER AND ZINC IN WATERS OF THE STATE OF PIAUI, BRAZIL (DETERMINACAO DE FERRO, MANGANESE, COBRE E ZINCO EM AGUAS DO ESTADO DO PIAUI, BRASIL).**  
Ceara Univ., Fortaleza (Brazil). Centro de Ciencias.  
J. Campos Accioly, and M. F. Santana Neves.  
Ciencia Agronomica, Vol 6, No 1-2, p 7-9, December, 1976. 1 tab, 4 ref.

**Descriptors:** \*Water analysis, \*Chemical analysis, \*Iron, \*Manganese, \*Copper, \*Zinc, \*Spectrophotometry, \*Brazil, Pollutant identification, Analytical techniques, Water wells, Arid lands.

Water from 37 wells in the state of Piaui, located in Brazil's arid Northeast, was tested for iron, manganese, copper and zinc content using atomic-absorption spectrophotometry. These concentrations varied respectively from 0.016 to 0.516 mg per liter; 0.01 to 0.032 mg per liter; 0.03 to 0.275 mg per liter; and 0.017 to 2.133 mg per liter. The average values of these metals were 0.100 mg per liter (iron); 0.007 mg per liter (manganese); 0.031 mg per liter (copper) and 0.421 mg per liter (zinc). With the exception of 5.4% of the iron samples, the other elements were present in lower concentrations than the maximum levels established by the World Health Organization. (Russell-Arizona)  
W78-12214

**DETERMINATION OF BORON IN WATERS OF THE STATE OF PIAUI, BRAZIL (DETERMINACAO DE BORO EM AGUAS DO ESTADO DO PIAUI, BRASIL).**  
Ceara Univ., Fortaleza (Brazil).  
J. Campos Accioly, and M. F. Santana Neves.  
Ciencia Agronomica, Vol 6, No 1-2, p 3-5, December, 1978. 1 tab, 5 ref.

**Descriptors:** \*Water analysis, \*Chemical analysis, \*Boron, \*Brazil, \*Pollutant identification, Water wells, Arid lands, Analytical techniques.

Boron was found in water samples collected from 37 wells in the state of Piaui, located in Brazil's arid Northeast. The samples were tested using electrometric titrations. Concentrations varied from 0.06 mg per liter to 0.87 mg per liter, with an average of 0.23 mg per liter. Since the maximum tolerable level of boron in drinking and irrigation water is 1 mg per liter, there is no evidence for boron pollution in the waters of Piaui. As this area has a long history of droughts, it is important to ascertain the chemical content of the available water supply. (Russell-Arizona)  
W78-12215

**ON THE STATE OF SATURATION OF GROUNDWATER WITH RESPECT TO DISSOLVED CARBONATES, EDWARDS AQUIFER, SOUTH-CENTRAL TEXAS.**  
San Diego State Univ., CA. Dept. of Geological Sciences.  
P. L. Abbott.  
The Texas Journal of Science, Vol 29, Nos 3-4, p 159-167, December, 1977. 1 tab, 1 fig, 12 ref.

**Descriptors:** Groundwater movement, \*Subsurface flow, Calcite, Dolomite, \*Caves, \*Limestones, \*Texas, \*Edwards Aquifer(Tex), \*Carbonates, Dissolved solids.

Long distances of groundwater flow through limestone would presumably result in water unable to dissolve host rock due to its saturation or supersaturation with respect to calcite and dolomite. However, groundwater flowing through the Edwards Limestone in the Balcones Fault Zone has created extensive caverns near the discharge-dominated end of the flow system even after travelling over 100 miles. The well-developed caverns result from the general undersaturation of the Edwards aquifer water. At least seasonal undersaturation is maintained by introduction of small amounts of flood recharge in Medina, Bexar and Comal counties to the groundwater body. (Russell-Arizona)  
W78-12216

**SAMPLING FREQUENCY FOR RIVER QUALITY MONITORING.**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5A.

W78-12239

**INTERLABORATORY QUALITY CONTROL STUDY NO. 16, TOTAL MERCURY IN NATURAL WATERS.**  
Canada Centre for Inland Waters Burlington (Ontario).  
For primary bibliographic entry see Field 5A.  
W78-12259

**ENRICHMENT OF ANIONS OF WEAK ACIDS BY DONNAN DIALYSIS.**  
Southern Illinois Univ. at Carbondale. Dept. of Chemistry and Biochemistry.  
For primary bibliographic entry see Field 5A.  
W78-12266

**USE OF HYDROCHEMICAL TECHNIQUES IN GROUNDWATER EXPLORATION IN THE VENTERSTAD AREA, CAPE PROVINCE (IN AFRIKAANS).**  
For primary bibliographic entry see Field 2F.  
W78-12465

**CALCIUM CARBONATE PRECIPITATION KINETICS PART 2. EFFECTS OF MAGNESIUM.**  
L. Benjamin, R. E. Loewenthal, and G. R. Marais.  
Water SA, (Pretoria), Vol 3, No 3, p 155-165, 1977, 19 ref, 7 fig, 1 tab.

**Descriptors:** \*Calcium carbonate, \*Chemical precipitation, \*Reaction kinetics, Magnesium, Interfering substances, Water softening, Calcites, Solubility products, Rate constants, Supersaturation, Crystals, Hydrogen ion concentration, \*South Africa.

The precipitation kinetics of CaCO<sub>3</sub> in the presence of Mg(+2) can be formulated in terms of the hypothesis of Davies and Jones for calcite seeded solutions. The apparent solubility product, K(spa), is related to the solubility product for magnesium calcite, K(spm). Both the solubility product for magnesium calcite, K(spm), and the precipitation rate constant, K, vary with the ratio of magnesium to calcium in the aqueous solution. (So Afr Water Info Ctr)  
W78-12469

**THE USE OF A SLOTTED QUARTZ TUBE FOR THE ANALYSIS OF TRACE METALS IN FRESH WATER.**  
Council for Scientific and Industrial Research, Pretoria (South Africa).  
For primary bibliographic entry see Field 5A.  
W78-12494

**SAMPLING, PRESERVATION AND STORAGE OF WATER SAMPLES FOR ANALYSIS OF METALS.**  
Norsk Inst. for Vannforskning, Blindern.  
A. Henriksen, and K. Balmer.  
Vatten 33(1), p 33-38, 1977.

**Descriptors:** Cadmium, Copper, Iron, Lakes, Lead, Manganese, Norway, Zinc, \*Metals, \*Water analysis, \*Sampling.

Concentrations of heavy metals in unpolluted surface waters are generally low, often below or near the detection limit of routine analytical methods. Reliable analysis thus is critically dependent on sample collection, preservation and analytical procedures that minimize contamination and chemical changes during storage. A method suitable for routine use was developed and tested. Water samples are collected in 25-ml glass vials with polyethylene snap-caps that were washed in succession with solutions of 1% Na-EDTA and 5% Deconex detergent, soaked in nitric acid and thoroughly rinsed with distilled water. After ar-

rival at the with 0.25 m tions of hea determined trophotome from sampl indicates the acid nor the vation and concentration of Pb and C trations of analytical d pled. This p collection a small lakes 1978, Biolog W78-12524

**STUDIES WATERS CREEK AT ON, WISCONSIN**  
Wisconsin vironmenta For primary W78-12603

**INVESTIG TY OF COMPOUN**  
Tennessee gineering. For primary W78-12607

**CHEMIST CHANGES MELTING**  
Norsk Inst M. Johann Res 619, August

**Descriptor**  
\*Water ch vestigation Chemicals Runoff, St

Over much precipitation tained in p to be relea mospheric estimated in Norwa probably with little the pollut Laborator dicated t released w average co is 2-2.5 tim self. The than 5 tim high concn concentration and melti preferen resulting i buffered aquatic or This proc the hatchi (ISWS) W78-1263

**SPATIAL CAL VAL**



rival at the laboratory the samples are preserved with 0.25 ml 3.5 N nitric acid, and the concentrations of heavy metals (Zn, Pb, Cu, Cd, Mn and Fe) determined by flameless atomic-absorption spectrophotometry. Statistical evaluation of results from samples collected from 18 lakes in Norway indicates that neither the time of addition of nitric acid nor the length of time between sample preservation and analysis greatly affects the measured concentrations of Zn, Pb, Mn and Fe. Evaluation of Pb and Cd was precluded because the concentrations of these metals was at or below the analytical detection limit in most of the lakes sampled. This procedure was successfully used in the collection and analysis of water samples from 261 small lakes in all of Norway in 1974-75.—Copyright 1978, Biological Abstracts, Inc. W78-12524

#### STUDIES OF TRACE METALS IN THE WATERS AND SEDIMENTS OF BADFISH CREEK AND LAKE WINGRA, NEAR MADISON, WISCONSIN.

Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.

For primary bibliographic entry see Field 5A. W78-12603

#### INVESTIGATION OF THE CHEMICAL IDENTITY OF SOLUBLE ORGANOPHOSPHORUS COMPOUNDS FOUND IN NATURAL WATERS, Tennessee Univ., Knoxville. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5A. W78-12607

#### CHEMISTRY OF SNOW MELTWATER: CHANGES IN CONCENTRATION DURING MELTING.

Norsk Institutt for Vannforskning, Blindern.

M. Johannessen, and A. Henriksen.

Water Resources Research, Vol 14, No 4, p 615-619, August 1978. 7 fig, 4 tab, 12 ref.

Descriptors: \*Snow, \*Snowmelt, \*Melt water, \*Water chemistry, Laboratory tests, On-site investigations, Lysimeters, Snowpacks, Melting, Chemicals, Hydrogen ion concentration, Acids, Runoff, Streams, Fish, Water quality, \*Norway.

Over much of Norway a large portion of the yearly precipitation falls as snow, and the pollutants contained in precipitation accumulate in the snowpack to be released during a short period in spring. Atmospheric fallout of sulfur compounds has been estimated to be about 30% of the total deposition in Norway, but fallout on the snow cover is probably considerably smaller. During winters with little or no snowmelt before spring, most of the pollutant load is retained in the snowpack. Laboratory and field lysimeter experiments indicated that 50-80% of the pollutant load is released with the first 30% of the meltwater. The average concentration of pollutants in this fraction is 2-2.5 times the concentration in the snowpack itself. The very first fractions may contain more than 5 times the snowpack concentrations. These high concentrations may be due to a freeze-concentration process during snow recrystallization and melting in which contaminants accumulate preferentially at the surfaces of ice particles. The resulting increase in the acid concentration of low-buffered water courses occasionally leads to physiological stress to fish and other aquatic organisms and even to massive fish kills. This process occurs at a time which is critical to the hatching stage of salmonid fish species. (Sims-ISWS)

W78-12630

#### SPATIAL AND TEMPORAL HYDROCHEMICAL VARIATIONS IN A SEMICONFINED BU-

#### RIED CHANNEL AQUIFER: ESTERHAZY, SASKATCHEWAN, CANADA.

Waterloo Univ. (Ontario). Dept. of Earth Sciences.

C. C. Davison, and J. A. Vonhof.

Ground Water, Vol 16, No 5, p 341-351, September-October 1978. 8 fig, 3 tab, 30 ref.

Descriptors: \*Aquifers, \*Groundwater, \*Water chemistry, \*Canada, On-site data collections, On-site investigations, Surveys, Sampling, Chemicals, Chemical analysis, Hydrogen ion concentration, Oxidation-reduction potential, Iron, Calcite, Dolomite, Gypsum, Silicates, Carbonates, Hydrology, Chemistry, Groundwater chemistry, Hydrochemical variations.

Groundwater samples from a portion of a semiconfined, buried glacial channel aquifer in southeastern Saskatchewan, Canada, were collected and analyzed to determine the spatial and temporal variations of the major chemical constituents, pH, Eh and Fe. Dilute Ca-HCO<sub>3</sub> type water characterized the shallow portion of the aquifer. There was a linear modified Piper Plot trend toward more concentrated Na-SO<sub>4</sub> type water with increasing depth in the aquifer and with increased distance along the groundwater flow path. Groundwater flowing from a well penetrating the shallow portion of the aquifer responded chemically to an intense spring storm event. The groundwater chemistry of a flowing well completed in the deep portion of the aquifer did not respond to this intense spring storm, but showed a temporal chemical trend which paralleled a midsummer recharge event. The spatial and temporal hydrogeochemical variations indicated that two chemically distinct groundwater components, resulting from two different physicochemical groundwater flows origin, are probably recharging and mixing within this portion of the buried channel aquifer. (Sims-ISWS)

W78-12637

#### USE OF LABORATORY DATA TO PREDICT SULFATE SORPTION DURING ARTIFICIAL GROUND-WATER RECHARGE.

Geological Survey, Reston, VA. Water Resources Div.

For primary bibliographic entry see Field 4B.

W78-12724

#### UNSTEADY SOLUTE-TRANSPORT SIMULATION IN STREAMFLOW USING A FINITE-DIFFERENCE MODEL.

Geological Survey, Bay St. Louis, MS. Water Resources Div.

For primary bibliographic entry see Field 5B.

W78-12726

#### STREAM QUALITY IN THE SAN LORENZO RIVER BASIN, SANTA CRUZ COUNTY, CALIFORNIA.

Geological Survey, Menlo Park, CA. Water Resources Div.

For primary bibliographic entry see Field 5B.

W78-12734

#### MECHANISMS OF HYDROGEN SULFIDE RELEASE FROM COASTAL MARINE SEDIMENTS TO THE ATMOSPHERE.

Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.

For primary bibliographic entry see Field 2L.

W78-12848

## 2L. Estuaries

#### CIRCULATION IN AN OPEN BAY,

Bedford Inst. of Oceanography, Dartmouth

(Nova Scotia). Atlantic Oceanographic Lab.

B. Petrie, and K. Drinkwater.

Journal of the Fisheries Research Board of Canada, Vol. 35, No. 8, p 1116-1123, August 1978. 7 fig, 1 tab, 8 ref.

Descriptors: \*Water circulation, \*Bays, \*Canada, \*Tidal waters, On-site investigations, Data processing, Coasts, Circulation, Tides, Fish eggs, Fish, Temperature, Water temperature, Salinity, Winds, Currents(Water), Oceanography, \*St. Georges Bay, \*Nova Scotia.

The circulation of St. Georges Bay, Nova Scotia, under stratified conditions was presented. The mean surface circulation is characterized by a clockwise eddy with velocities of about 10 cm/s. Bottom (30 m) flow at the mouth was found to be less than 2 cm/s out of the bay. Depth-averaged currents still exhibit the clockwise eddy. Although energy was found to be equally partitioned among the mean circulation, the tides, and low-frequency events, the latter determines the rate of exchange between the bay and the Gulf of St. Lawrence. Estimates of flushing time for tides and the mean circulation was of the order of a month, while low-frequency events could flush the bay on a time scale of days. Low correlation between current meters reveals that the vertical and horizontal length scales of the bay are less than 10 m and 5 km, respectively. The circulation and exchange rates can significantly affect the dispersal (or exchanges with populations existing outside the bay) for passive particles such as fish eggs or larvae. (Sims-ISWS)

W78-12163

#### COMPUTER-AIDED ANALYSIS OF LANDSAT DATA FOR SURVEYING TEXAS COASTAL ZONE ENVIRONMENTS.

Purdue Univ., Lafayette, IN. Lab. for Applications of Remote Sensing.

For primary bibliographic entry see Field 7C.

W78-12178

#### CALIFORNIA COASTAL PROCESSES STUDY - LANDSAT II. FINAL REPORT: LANDSAT INVESTIGATION NO 22200.

Army Engineer District, San Francisco, CA.

For primary bibliographic entry see Field 5C.

W78-12179

#### SUBLETHAL EFFECTS OF SUSPENDED SEDIMENTS ON ESTUARINE FISH.

Maryland Univ., Solomons. Natural Resources Inst.

For primary bibliographic entry see Field 5C.

W78-12183

#### DIURNAL AND SEASONAL FLUCTUATIONS OF ORGANISMS IN A NORTH FLORIDA ESTUARY.

Florida State Univ., Tallahassee. Dept. of Biological Science.

For primary bibliographic entry see Field 5C.

W78-12186

#### MODELING OF TIDE AND WIND INDUCED FLOW IN SOUTH BISCAYNE BAY AND CARD SOUND.

Miami Univ., FL.

E. A. Swakon, Jr., and J. D. Wang.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-272 815. Price codes: A08 in paper copy, A01 in microfiche. Technical Bulletin No. 37, June 1977. 159 p, 39 fig, 10 tab, 20 ref, 5 append. SG-04-5-158-14.

Descriptors: \*Winds, \*Tidal effects, \*Models, \*Florida, Baseline studies, Water quality, Resources development, Outer Continental Shelf, Biscayne Bay, Card Sound, Flushing, Convective transport, Environmental impact.

### Group 2L—Estuaries

**SIGNIFICANCE OF PHENOLIC COMPOUNDS  
IN THE DELAWARE ESTUARY,**  
Rutgers - The State Univ., New Brunswick, NJ.  
Water Resources Research Inst.  
For primary bibliographic entry see Field 5C.  
W78-12190

**PRODUCTION OF EPIBENTHIC SALT MARSH ALGAE: LIGHT AND NUTRIENT LIMITATION,**  
Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program.  
For primary bibliographic entry see Field SC.  
W78-12206

**OCS DEVELOPMENT IN COASTAL LOUISIANA: A SOCIO-ECONOMIC IMPACT ASSESSMENT,**  
New Orleans Univ., L.A. Urban Studies Inst.  
For primary bibliographic entry see Field 6B.  
W78-12307

Computer simulations by Barataria Bay show that changes due to the canals. The model parameters in the construction of the canals, ways, and the gas fields. The 90% of the simulation was due to the effects of the small, but probably are in the waterways, in the Basin. The average by about normal conditions. The tidal cycle in the intermediate range. The exchange process reduced between the flow through the automatic studies. The them, and the production and the investment project should be carried out.

**CLIMATOLOGY, HYDROLOGY, AND HYDROGRAPHY OF THE VERMILION BASIN. SYNOPTIC WEATHER TYPES AND ENVIRONMENTAL RESPONSES. HYDROLOGIC AND HYDROGRAPHIC PROCESSES.**

Louisiana State Univ., Baton Rouge. Center for Wetland Resources.

C.L. Wax, R.A. Muller, and M.J. Borengasser. Louisiana State University Center for Wetland Resources Final Report to Louisiana State Planning Office, June 30, 1977. 117 p, 30 fig, 14 tab, 23 ref.

Descriptors: \*Louisiana, \*Weather, \*Water level, \*Wetlands, \*Environmental effects, Resources development, Hydrography, Hydrology, Coasts, Climatology, Coastal Zone Management, \*Vermilion Basin(La).

The Vermilion Basin is located along the central Louisiana coast, about midway between New Orleans and Lake Charles. The Vermilion River is the primary drainage system of the basin, which is separated from the Mermentau Basin to the west by a system of locks on canals crossing the drainage divide. The first part of the report presents an analysis of relationships between climatic inputs and water level regimes in the Vermilion Basin estuaries to illustrate how elements of the environment respond to variations in weather as indexed by the synoptic weather type calendars. The second part of the report deals with the impact of man in the Vermilion Basin which was dictated by the need for freshwater supply to irrigate rice fields in the area. In meeting this requirement extensive systems of water control structures were installed. This resulted in interruption of the normal estuarine/marshland nutrient cycle through periodic blockage of water circulation between marsh habitats and Vermilion Bay. (NOAA)

W78-12308

**SIMULATED HYDROLOGIC EFFECTS OF CANALS IN BARATARIA BASIN: A PRELIMINARY STUDY OF CUMULATIVE IMPACTS.**

Louisiana State Univ., Baton Rouge. Center for Wetland Resources.

J.H. Stone, and G.F. McHugh. Louisiana State University Center for Wetland Resources Final Report to Louisiana State Planning Office, June 30, 1977. 43 p, 1 fig, 19 tab, 7 ref, append.

Descriptors: \*Louisiana, \*Canals, \*Environmental effects, Hydrography, Dredging, \*Simulation analysis, Computer simulations, Coastal Zone Management, Environmental impact, \*Barataria Basin(La).

Computer simulation of the hydrography of Barataria Basin indicate significant hydrologic changes due to navigation and transportation canals. The simulations compared hydrologic parameters in the Basin before and after the construction of the Barataria and Intracoastal Waterways, and the canals associated with eight oil and gas fields. The waterways accounted for about 90% of the simulated changes; the remaining 10% was due to the canals of the eight oil and gas fields. The effects of oil and gas canals are individually small, but they are cumulative and, overall, probably are just as significant as those due to waterways, since there are approximately 90 fields in the Basin. Water heights increased on the average by about 2 inches, or more than 9% above normal conditions. Total water flow over a 25-hour tidal cycle increased between 7 and 16% in the intermediate marshes. Water flow at individual exchange points in the freshwater marshes was reduced between 20 and 70% of normal. Water flow through tidal passes was not changed. Systematic studies of these effects, how to mitigate them, and how they are related to biological production are badly needed. Large-scale development projects, which require waterways or canals, should be carefully evaluated and monitored to

determine their full environmental effects. (NOAA)

W78-12309

**OUTER CONTINENTAL SHELF IMPACTS, MORGAN CITY, LOUISIANA.**

University of Southwestern Louisiana, Lafayette.

For primary bibliographic entry see Field 6G.

W78-12310

**THE USE OF CARBON AND SULFUR ISOTOPIC RATIOS AND TOTAL SULFUR CONTENT FOR IDENTIFYING THE ORIGIN OF BEACH TARS IN SANTA MONICA BAY, CALIFORNIA.**

University of Southern California, Los Angeles. Sea Grant Program.

For primary bibliographic entry see Field 5B.

W78-12311

**DECISIONS FOR DELAWARE: SEA GRANT LOOKS AT BEACH MANAGEMENT.**

Delaware Univ., Newark. Coll. of Marine Studies.

P.A. Jensen, R.A. Dalrymple, and B.W. Lee.

Delaware University College of Marine Studies Sea Grant Report No. DEL-SG-7-78, August 1978.

32 p, 18 ref.

Descriptors: \*Delaware, \*Beach erosion, \*Shore protection, Management, Water resources, Littoral drift, Coastal zone management.

Along Delaware's coast, natural processes cause erosion at a rate of 3 to 9 feet each year in some places. Severe storms—for which Delaware is essentially unprepared—may cause considerable property damage and threaten the lives of many people. The situation has prompted demands for protective actions which in many cases have proven expensive and not very effective. Sea level continues to rise about 5 inches each century. And because of the orientation of Delaware's coast, waves produce a longshore current that scours sand from the beach and carries it northward. Nothing can be done to permanently halt the loss of land to the sea. However, some temporary measures can be taken to slow down the process or adapt to it. At least four paths to follow emerge from this discussion. One path is to attempt to hold the line by massive erosion-control structures. Another is to do little and let nature take its course. A third is to continue on as before. The fourth path involves some elements of the other three and would be largely a continuation of present policy—maintain dunes and continue small-scale beach nourishment where feasible, but with significant modifications in building regulations and increased research. (NOAA)

W78-12312

**DEVELOPMENT OF DRAINAGE BASIN-ESTUARY NUMERICAL MODEL SYSTEM FOR PLANNING OF THE COASTAL ZONE.**

Florida Univ., Gainesville. Dept. of Civil Engineering.

D.S. Graham, and B.A. Christensen.

Reprinted from: Coastal Zone '78, Proceedings of the Symposium on Technical, Environmental, Socioeconomic and Regulatory Aspects of Coastal Zone Management, ASCE, San Francisco, Calif. March 14-16, 1978. p 621-633, 3 fig, 1 tab, 41 ref. SG-04-7-158-44046.

Descriptors: \*Estuaries, \*Coasts, \*Mathematical models, \*Florida, Drainage area, Planning, Model studies, Coastal zone management.

Proper management of Florida's coastal zone requires the ability to predict the effects of basin activities on influents. Mathematical models now exist which have successfully simulated both basin and estuarine water quality and discharges. Selected proven and available models will be linked to simulate most of the hydrosystem and verification will be attempted on a relatively sim-

ple prototype for which a substantial data base exists. This will provide a solid basis for application to more complicated and stressed localities. (NOAA)

W78-12316

**BEACH PROFILES OBTAINED WITH AN AMPHIBIOUS DUKW ON THE OREGON AND WASHINGTON COASTS.**

Oregon State Univ., Corvallis. Dept. of Oceanography.

P.D. Komar.

Oregon State University Sea Grant Reprint No. ORESU-R-77-037, Reprinted from: The Ore Bin, Vol 39, No. 11, p 169-180, November 1977. 8 fig, 1 tab, 15 ref. SG-04-6-158-44004.

Descriptors: \*Beach erosion, \*Sand bars, \*Oregon, \*Washington, \*Beach profiles, Longshore, Wave conditions, Beach morphology.

The beach profiles that were obtained with an amphibious DUKW during University of California investigations show one, two, or three offshore bars at various localities on Oregon and Washington beaches. All bars can migrate in the on-offshore direction under changing wave conditions and alter their depths in the process. There may be appreciable longshore variations in the nature of the beach profiles. The data include examples where one profile has a pronounced bar-and-trough system, and at the same time, some 1,000 to 2,000 feet in the longshore direction, the beach profile is flat. Such longshore changes in the profiles can be best explained as having been caused by a system of longshore currents feeding offshore-flowing rip currents. The beach profiles obtained by the study are particularly valuable in that they extend across the entire nearshore zone and include information on the outer bars and troughs. Beach profiles obtained with the conventional stadia rod and transit are confined to the inner surf zone, seldom reaching the middle bar and never the outer bar. Considering the intensity of the surf on Oregon and Washington beaches and the difficulties of measurement in this zone, it is doubtful whether additional profiles that span the entire nearshore will be obtained. (NOAA)

W78-12317

**THE ANNUAL CYCLE OF PROFILE CHANGES OF TWO OREGON BEACHES.**

Oregon State Univ., Corvallis. School of Oceanography.

N.A. Aquilar-Tunon, and P.D. Komar.

Oregon State University Sea Grant Reprint No. ORESU-R-77-038, Reprinted from: The Ore Bin, Vol 40, No 2, p 25-39, February 1978. 9 fig, 31 ref. SG-04-6-158-44004.

Descriptors: \*Beach erosion, \*Oregon, Seasonal, Beaches, \*Beach profiles, Wave conditions, Annual cycles.

Two Oregon coast beaches with significant differences in grain size, and thus in beach profile morphology and response to wave conditions, were studied. The purpose of the investigation is to allow the prediction of the amount of beach erosion or deposition from a knowledge of the wave conditions. In general, for the Oregon beaches studied, the principal beach erosion occurred during storm conditions when wave breaker heights exceeded 5 to 6 m (16 to 20 ft). Deposition occurred when there was no major storm and breaking waves averaged 4 m (13 ft) or less. Wave steepness showed a poorer relationship to the erosion/deposition than did breaker heights, indicating that the wave period was not a significant factor in the on-shore-offshore shift of sand and the resulting changes in the beach profile type. (NOAA)

W78-12318



## Field 2—WATER CYCLE

### Group 2L—Estuaries

**ON THE BEACH - INFRARED SPECTROSCOPY IN THE REAL WORLD.**  
Rhode Island Univ., Kingston. Dept. of Chemistry.  
For primary bibliographic entry see Field 5A.  
W78-12322

**'BASELINE MONITORING STUDIES, MISSISSIPPI, ALABAMA, FLORIDA, OUTER CONTINENTAL SHELF, 1975-1976' VOLUME III, RESULTS.**  
State Univ. System of Florida Inst. of Oceanography, St. Petersburg.  
For primary bibliographic entry see Field 7C.  
W78-12328

**STATE OF NORTH CAROLINA COASTAL MANAGEMENT PROGRAM AND DRAFT ENVIRONMENTAL IMPACT STATEMENT. APPENDICES.**  
North Carolina Dept. of Natural Resources and Community Development, Raleigh.  
For primary bibliographic entry see Field 6G.  
W78-12334

**STATE OF NORTH CAROLINA COASTAL MANAGEMENT PROGRAM AND DRAFT ENVIRONMENTAL IMPACT STATEMENT.**  
North Carolina Dept. of Natural Resources and Community Development, Raleigh.  
For primary bibliographic entry see Field 6G.  
W78-12335

**EFFECTS OF KEPONE ON ESTUARINE ORGANISMS.**  
Environmental Research Lab., Gulf Breeze, FL.  
For primary bibliographic entry see Field 5C.  
W78-12378

**SOUTH AFRICAN MARINE POLLUTION SURVEY REPORT 1974-1975.**  
Council for Scientific and Industrial Research, Johannesburg (South Africa).  
For primary bibliographic entry see Field 5B.  
W78-12400

**BIBLIOGRAPHY ON MARINE POLLUTION IN SOUTH AFRICA.**  
Council for Scientific and Industrial Research, Johannesburg (South Africa).  
For primary bibliographic entry see Field 5B.  
W78-12404

**MATHEMATICAL MODELS FOR SIMULATING MONTHLY WATER LEVELS AND SALINITIES IN SHALLOW LAKES.**  
University of the Witwatersrand, Johannesburg (South Africa).  
I. P. G. Hutchison.  
Hydrological Research Unit Report No. 6/75, 1975, 11 ref.

Descriptors: \*Mathematical models, \*Simulation analysis, \*Water level fluctuations, \*Salinity, \*Lakes, \*Physicochemical properties, \*Shallow water, \*Water circulation, \*Statistical analysis, \*Estuaries, \*Computer programs, \*Lake St. Lucia estuary (So Afr), South Africa.

The flow of water in estuaries is studied with the aid of a mathematical cell-type model. Flows between cells are established employing head loss or continuity relationships. Salinity is studied using dispersion equations. The flows in the St. Lucia estuary in South Africa are simulated on a monthly basis using the derived computer programs. (So Afr Water Info Ctr)  
W78-12411

**TOXICITY STUDIES ON MARINE ANIMALS.**  
Cape Town Univ. (South Africa). Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W78-12424

**OIL IN THE MARINE ENVIRONMENT.**  
Department of Planning and the Environment, Cape Town (South Africa).  
For primary bibliographic entry see Field 5G.  
W78-12447

**A NEW SPECIES OF HALICYCLOPS (COPEPODA, CYCLOPOIDA) FROM ESTUARIES IN TRANSKEI, SOUTHERN AFRICA.**  
Port Elizabeth Univ. (South Africa).  
T. Wooldridge.  
Annals of the South African Museum (Cape Town), Vol. 73, No. 10, p. 361-371, 1977. 20 ref, 1 tab, 3 fig.

Descriptors: \*Halicyclops pondoensis, \*Copepoda, \*Cyclopoida, Estuaries, Marine animals, Species description, Species distribution, Geographical distribution, \*South Africa.

A new species of the genus Halicyclops Norman, 1903, is described and illustrated from estuaries in Transkei, southern Africa. The species, Halicyclops pondoensis is closely allied to H. neglectus, H. rotundipes and H. higoensis. It is distinguished from these three forms particularly in regard to the fourth and fifth pair of legs. In H. pondoensis hair-like structures are present in the proximal part of the seta of the first endopodite segment of leg 4. These hair-like structures are absent in other species. Two spines and three setae are present on leg 5 of the male of H. pondoensis. In H. neglectus, H. rotundipes and H. higoensis the male 5th leg in both the male and female is elongated. A key to the species recorded from the African continent south of the Tropic of Cancer, and from the islands of Madagascar and Reunion, is given. (So Afr Water Info Ctr)  
W78-12504

**TRACE METAL STUDIES IN KNYSNA ESTUARY.**  
Council for Scientific and Industrial Research, Pretoria (South Africa).  
For primary bibliographic entry see Field 5A.  
W78-12509

**AGENCY CREATED TO FIGHT COASTAL SUBSIDENCE MENACE.**  
Harris-Galveston Coastal Subsidence District, Houston, TX.  
For primary bibliographic entry see Field 6E.  
W78-12566

**SHOALING OF WAVES UNDER ICE.**  
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 2C.  
W78-12641

**INTEGRAL EQUATION FAILURE IN WAVE CALCULATIONS.**  
New Orleans Univ., LA. Dept. of Physics.  
J. E. Murphy.  
Journal of the Waterway, Port, Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Technical Note, Vol. 104, No. WW4, p. 330-334, August 1978. 5 ref, 1 append.

Descriptors: \*Waves(Water), \*Wavelengths, \*Ocean waves, \*Coastal structures, Theoretical analysis, Breakwaters, Mathematical studies, Equations, Mathematical models, Analytical techniques, Potential flow, Critical wavelengths, Vertical cylinders.

The purpose of the power was to show that there may be characteristic wavelengths for which the potential theory formulation breaks down, and the solution of the boundary value problem cannot be represented by a wave source integral formula. Failures of the potential theory formulation generally are expected to occur when the wavelength is less than the characteristic lineal dimension of the object. These considerations may be of interest in the analyses of wave interactions with large breakwaters or extremely large offshore structures, such as floating nuclear power plants and ocean thermal energy conversion plants. The existence of critical wave numbers for which a simple source representation for scattered waves fails was demonstrated. Although the calculations were performed for the case of scattering by vertical cylinders, such wave numbers probably exist for more complex geometries. Even though it is known that these critical wave numbers can be associated with solutions to a related boundary value problem, the physical nature of these singular values is still an open question. Generally, critical wave numbers are not expected to occur until the wavelength is on the order of or less than the characteristic lineal dimension of the submerged object. Consulting a table of roots of Bessel functions allows one to determine the critical wavelengths at which the simple source representation fails for the case of scattering by a vertical cylinder. (Humphreys-ISWS)  
W78-12642

**CIRCULATION, VARIABILITY, AND DYNAMICS OF THE SCOTIAN SHELF AND SLOPE.**  
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.  
P. C. Smith, B. Petrie, and C. R. Mann.  
Journal of the Fisheries Research Board of Canada, Vol. 35, No. 8, p. 1067-1083, August 1978. 14 fig, 5 tab, 40 ref.

Descriptors: \*Water circulation, \*Continental shelf, \*Continental slope, \*Model studies, \*Canada, \*On-site investigations, Measurement, Data processing, Tides, Tidal effects, Circulation, Waves(Water), Internal waves, Mixing, Oceans, Oceanography, \*Scotian Shelf, \*Nova Scotia, Reynolds stress, Wind-driven circulation.

A brief summary of historical data relating to the mean circulation on the Scotian Shelf and Slope revealed the distribution of various water masses and certain general characteristics of the current field, supported by geostrophic calculations and observations of surface drift. However, extreme variability resulting from wind and tidal forces was evident in all measurements made on the shelf and slope. Various measurements and models of the first-order variable flows, including wind-driven circulation, diurnal and semidiurnal tides, and inertial waves, also were reviewed. Results from a new model for inertial motions in a variable-depth mixed layer were found to reproduce closely the transient behavior of inertial energy at the 50-m depth on the shelf, but certain aspects of the model were inconsistent with the observations. With results from a mooring program on the shelf in September-December 1968, the dynamics of the mean circulation were examined in the context of a vertically integrated, two-dimensional model. Reynolds stresses associated with the first-order flows were found to be insignificant in the inshore zone (within 90 km of the coast) where the balances are between mean wind and bottom stresses, surface pressure gradients, and Coriolis forces. Over the outer shelf, however, the geostrophic onshore balance breaks down, and Reynolds stress divergences in the inertial and tidal bands become important. At the shelf break, generation of the baroclinic semidiurnal tide produces internal Reynolds stress forces comparable to the barotropic terms on the shelf. (Sims-ISWS)  
W78-12643



**BEACH TOPOGRAPHY AND BEACH CUSPS**, Maryland Univ., Baltimore. Dept. of Geography. R. N. Dubois. Geological Society of America Bulletin, Vol. 89, No. 8, p 1133-1139, August 1978. 10 fig, 20 ref.

Descriptors: \*Beaches, \*Topography, \*Delaware, Tides, Oceanography, Hydraulics, Geology, Berms, Waves(Water), \*Beach cusps, Tidal berm, Backshore, Swash salients, Incident waves, Edge waves, Beach topography.

The development of beach cusps was studied along the northern shore of Delaware from June 9 through June 30, and from July 28 through August 10 of 1976. At the study site, the formation of beach cusps was dependent upon the existence of a tidal berm in the developing stage and of a favorable backshore topography. Beach cusps developed as follows: after an erosional event on a sandy beach, a berm developed at low tide. The swash extended over the berm and ponded between the berm and the backshore. The stream flow from the ponded water to the sea cut closely spaced channels through the berm. As the tide rose, the berm and channels migrated landward. When the tide fell, the swash could no longer overtop the berm, and no water was ponded landward of the berm. Since no water was returning seaward through the channels, the channel form could not be maintained, and the swash flared the channels into bays. A series of beach cusps appeared on the beach as the tide continued to fall. The spacing between cusps was irregular and was attributed to the irregular size of swash salients. At high tide, the horizontal distance from the berm crest to the backshore (L) was less than 12 m. At high tide where L was greater than 12 m, no beach cusps formed. Although a tidal berm developed, there was no effective backwash to cut through the berm. As the new tidal berm developed and as the swash overtopped the berm crest, the swash continued landward, and during a short period of time flooded a portion of the backshore. No cusps were observed to develop after a tidal berm had been constructed; berms and cusps developed together. (Lee-ISWS) W78-12647

#### **TANKERS AND OIL TRANSFER OPERATIONS ON THE DELAWARE RIVER AND BAY.**

Comptroller General of the United States, Washington, DC. For primary bibliographic entry see Field 5G. W78-12656

#### **FACTOR ANALYSIS OF THE BIOGENOSES OF AQUATIC COLEOPTERA OF THE MARSHES OF LOWER GUADALQUIVIR (SPAIN), (IN FRENCH).**

Seville Univ. (Spain). Dept. of Zoology. A. C. Soler Andres, C. Montes Del Olmo, and L. Ramirez Diaz. Ann Limnol 12(1), p 89-103, 1976.

Descriptors: \*Statistical methods, \*Biological communities, \*Aquatic insects, \*Marshes, \*Aquatic environment, Environment, Physical properties, Chemical properties, Water temperature, Hydrogen-ion concentration, Magnesium, Calcium, Sulfates, Chlorides, Temperature, Coleoptera, Water depth, Guadalquivir, Spain, \*Factor analysis.

Principal component analysis was used to study the biocenotic relationships between aquatic Coleoptera and 8 physical-chemical factors of the environment. Because of the large range of spatial and temporal conditions considered in this work, a preliminary analysis of 58 samples and 31 spp. showed a multidimensional structure in which it was not possible to detect ecological, faunistic or geographical affinities. Two analyses of samples taken from more homogenous environments (19 samples and 25 spp. from the marsh; 15 samples and 23 spp. from the rice field) revealed groups of

species with a similar distribution. The significant correlations between the components of these analyses and environmental factors (temperature, pH, Chloride, sulphate, Mg, Ca and water depth) determined the ecological groups which were indicators of certain levels of environmental conditions. Daily variations in the community were more important than seasonal changes.—Copyright 1978, Biological Abstracts, Inc. W78-12661

#### **OPTIONS FOR MONITORING LOCAL PERMITS IN THE NORTH CAROLINA COASTAL AREA.**

North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning. For primary bibliographic entry see Field 6E. W78-12662

#### **MICROBIAL ECOLOGY STUDIES OF METULA SPILL IN THE STRAITS OF MAGELLAN, MARYLAND UNIV., COLLEGE PARK. Dept. of Microbiology.**

For primary bibliographic entry see Field 5C. W78-12673

#### **SEED VIABILITY IN SALT MARSH TAXA, GEORGETOWN COUNTY, SOUTH CAROLINA.**

Saint John's Univ., Jamaica, NY. Dept. of Biology. R. Stalter, and W. T. Batson. Castanea, Vol 38, No 1, p 109-110, March, 1973. 1 tab.

Descriptors: \*Salt marshes, \*Marsh plants, \*Viability, Wetlands, Marshes, Seeds, Germination, \*South Carolina, Georgetown County(SC).

Seeds were tested for viability from five salt marsh species and two salt marsh fringe species. Less than 10% of the seeds of *Spartina patens* and *Spartina alterniflora* are viable. *Iva frutescens* produces a greater proportion of viable seeds than the former two species, but the values are less than 50%. Species demonstrating moderate seed viability are *Panicum virgatum*, *Solidago sempervirens*, and *Sporobolus virginicus*. *Borrichia frutescens* produces the greatest percentage of viable seeds, 97%. (Steiner-Mass) W78-12683

#### **SEED VIABILITY IN TWO ATLANTIC COAST POPULATIONS OF SPARTINA ALTERNIFLORA.**

Saint John's Univ., Jamaica, NY. Dept. of Biology. R. Stalter. Castanea, Vol 38, No 1, p 110-113, March, 1973. 1 tab, 15 ref.

Descriptors: \*Marsh plants, \*Viability, \*Salt marshes, Wetlands, Marshes, Seeds, Germination, Grasses, South Carolina, Connecticut, \*Spartina alterniflora.

The seeds in two populations of *Spartina alterniflora* near Charlestown, South Carolina, and Stonington, Connecticut, were tested for viability with tetrazolium chloride. The percentage of viable seeds in both populations was low, 8% for the population near Charlestown and 12% for the Stonington population. (Steiner-Mass) W78-12684

#### **VARIABILITY OF WETLAND REFLECTANCE AND ITS EFFECT ON AUTOMATIC CATEGORIZATION OF SATELLITE IMAGERY.**

Delaware Univ., Newark. Center for Remote Sensing. For primary bibliographic entry see Field 7B. W78-12690

#### **SEDIMENTATION RATES, SHORELINE MODIFICATION, AND VEGETATION CHANGES ON TIDAL MARSHES ALONG THE COAST OF CONNECTICUT, CORNELL UNIV., ITHACA, NY.**

E. Z. Harrison. Master's Thesis, June, 1975. 107 p.

Descriptors: \*Tidal marshes, \*Sedimentation, \*Seashores, \*Vegetation, \*Connecticut, Salt marshes, Coastal marshes, Wetlands, Sea level, Sediments, Erosion.

High marsh sedimentation rates are correlated with mean tide range at the five marsh sites studied. Average rates varied from 2 to 6.7 mm/yr. Correlation with mean tide range is best explained by the greater quantity of sediment-laden water that flows over sites with higher tide ranges. Over the past 10 years, high marsh sedimentation rates nowhere equaled the rapid short-term rise of sea level in Connecticut of 1 cm/yr. All of the marshes were progressively drowned during this interval. Over the past 40 years, however, the average rate of sea level rise (2 mm/yr) has been equaled or exceeded on all five sites. Over nine years, progradation occurred rarely, and marsh-edge retreat varied from none to a total of 14 m. Erosion rates seem to be related to protection from the short-period waves of Long Island Sound and sediment type. Changes in the elevation of mean high water from 1964 to 1973 were not reflected in the movement of the *Spartina alterniflora*/S. *patens* boundary. 'Breathing' of the marsh surface amounts to 5 to 8 mm vertical displacement. (Stihler-Mass) W78-12691

#### **1974 FINAL REPORT, RESEARCH ON SHORE AND UPLAND MIGRATORY BIRDS IN NEW JERSEY CLAPPER RAIL STUDIES.**

New Jersey Dept. of Environmental Protection, Trenton. Div. of Fish, Game, and Shellfisheries. For primary bibliographic entry see Field 21. W78-12696

#### **ENVIRONMENTAL PLANNING FOR OFFSHORE OIL AND GAS - VOLUME III, EFFECTS ON LIVING RESOURCES AND HABITATS.**

Conservation Foundation, Washington, DC. For primary bibliographic entry see Field 5G. W78-12697

#### **THE MARSHES OF MISSISSIPPI.**

Gulf Coast Research Lab., Ocean Springs, MS. L. N. Eleuterius. In: Cooperative Gulf of Mexico Estuarine Inventory and Study, Mississippi, p 147-190, 1973. 40 fig, 6 tab, 118 ref.

Descriptors: \*Mississippi, \*Marshes, \*Marsh plants, \*Distribution patterns, \*Productivity, Estuaries, Estuarine environment, Wetlands, Salt marshes, Freshwater marshes, Plant groupings, Salinity, *Juncus roemerianus*, Rushes, Marsh zonation.

Phytosociological techniques were used to determine the vascular composition of the marshes of Mississippi for three estuarine systems. *Juncus roemerianus*, a rush, dominates the marshes of Mississippi. Freshwater marshes exhibited a great diversity of species, whereas saline marshes were more homogeneous with few species. The diversity of species increased with lower salinity and resulted in a penetration of freshwater species into more saline areas and vice versa. Organic matter production was greater in the saline marsh than in the freshwater marsh. Marsh regions, based on species composition, were established and zonation of each region recorded. Ecological factors are discussed and maps denoting marsh types presented. Marsh acreage by marsh type and dominant species was determined. Total standing crop and annual production was estimated at 3 million tons. (See also W78-12698) (Steiner-Mass)

## Field 2—WATER CYCLE

### Group 21—Estuaries

W78-12702

**THE DISTRIBUTION OF CERTAIN SUBMERGED PLANTS IN MISSISSIPPI SOUND AND ADJACENT WATERS.**  
Gulf Coast Research Lab., Ocean Springs, MS.  
For primary bibliographic entry see Field 21.  
W78-12703

**ESTUARINE ZOOPLANKTON, MISSISSIPPI.**  
Gulf Coast Research Lab., Ocean Springs, MS.  
H. M. Perry, and J. Y. Christman.  
In: Cooperative Gulf of Mexico Estuarine Inventory and Study, Mississippi, p 198-254, 1973. 2 fig, 39 tab, 98 ref, 1 append.

Descriptors: \*Mississippi, \*Estuarine environment, \*Plankton, Estuaries, Distribution patterns, Zooplankton, Aquatic microorganisms, Mississippi Sound, Biloxi Bay (Mississippi), Copepods.

Plankton investigations were carried out through the central portion of Mississippi Sound and the Biloxi Bay estuary. Concurrent with the plankton samples, temperature, dissolved oxygen, salinity, and water transparency were measured. Freshwater, estuarine, and marine species made up the faunal components of the study. The populations were for the most part localized. Copepods were the dominant zooplankton group. *Acartia tonsa* was the most abundant plankton species. The influence of the ctenophore *Mnemiopsis mccradyi* on plankton volume is discussed. These predators probably play a large role in regulating the distribution and abundance of local plankton populations. (See also W78-12698) (Steiner-Mass)  
W78-12704

**ESTUARINE INVERTEBRATES, MISSISSIPPI.**  
Gulf Coast Research Lab., Ocean Springs, MS.  
For primary bibliographic entry see Field 21.  
W78-12705

**ESTUARINE VERTEBRATES, MISSISSIPPI.**  
Gulf Coast Research Lab., Ocean Springs, MS.  
J. Y. Christman, and R. S. Waller.  
In: Cooperative Gulf of Mexico Estuarine Inventory and Study, p 320-434, 1973. 11 fig, 36 tab, 99 ref.

Descriptors: \*Mississippi, \*Estuarine environment, \*Fish, Estuaries, Vertebrates, Commercial fish, Fish populations, Growth rate, Continental shelf.

The occurrence, relative abundance, seasonal and areal distribution, distribution in the salinity-temperature matrix, spawning and growth rate of fishes collected in the Mississippi estuarine study area are reported. A list of 294 fish species from Mississippi estuaries and continental shelf waters off Mississippi included 251 species observed in the study area. The bay anchovy, largescale menhaden, Atlantic croaker, spot, butterfish, and sand seatrout comprised 93% of the total number of fishes collected. The role of other vertebrates in the study area is discussed. (See also W78-12698) (Steiner-Mass)  
W78-12706

**SEWAGE SPRAY IRRIGATION IN A DELAWARE RIVER FRESHWATER TIDAL MARSH.**  
Rider Coll., Trenton, NJ. Dept. of Biology.  
For primary bibliographic entry see Field 5E.  
W78-12712

**THE FREQUENCY, DISTRIBUTION, AND PATHOLOGY OF THREE DISEASES OF DEMERSAL FISHES IN THE BERING SEA.**  
National Marine Fisheries Service, Seattle, WA.  
Northwest Fisheries Center.  
For primary bibliographic entry see Field 5C.

W78-12751

**LEAD AND COPPER IN THE WATERS OF RARITAN AND LOWER NEW YORK BAYS.**  
National Marine Fisheries Service, Highlands, NJ.  
Middle Atlantic Coastal Fisheries Center.  
For primary bibliographic entry see Field 5B.  
W78-12811

**SERIOUS MERCURY CONTAMINATION OF SEDIMENTS IN A NORWEGIAN SEMI-ENCLOSED BAY.**  
Norwegian Inst. for Water Research, Oslo (Norway).  
For primary bibliographic entry see Field 5B.  
W78-12815

**ACUTE TOXICITY OF ALKYL LEADS TO SOME MARINE ORGANISMS.**  
Istituto di Ricerca Sulla Acque, Milano (Italy).  
For primary bibliographic entry see Field 5C.  
W78-12816

**THE FRESHWATER REGIME OF FAXAFLÖI, SOUTHWEST ICELAND AND ITS RELATIONSHIP TO METEOROLOGICAL VARIABLES.**  
Iceland Univ., Reykjavik; and Marine Research Inst., Reykjavik (Iceland).  
U. Stefansson, and G. Guomundsson.  
Estuarine and Coastal Marine Science, Vol. 6, No. 6, p 535-551, June 1978. 6 fig, 3 tab, 9 ref.

Descriptors: \*Freshwater, \*Saline water-freshwater interfaces, \*Bays, \*Precipitation (Atmospheric), Rainfall, Snowfall, Runoff, Evaporation, Air-water interfaces, Winds, Coasts, Salinity, Water balance, Glaciers, Meltwater, Foreign research, Correlation analysis, Estuaries, \*Iceland.

On the basis of 15 surveys of 23 hydrographic stations in Faxaflöi, Southwest Iceland, and the adjacent shelf region in the period February 1966 to March 1967, the freshwater regime of the bay was studied in relation to meteorological and hydrological factors. The freshwater content inside the bay ranged between 19,500,000 and 53,500,000 cu m, with an average value of 31,640,000 cu m. Direct runoff into Faxaflöi averaged 29,280,000 cu m per day. However, the freshwater distribution, presented by means of charts of equivalent freshwater thicknesses, suggested that the freshwater input is due not only to local runoff and surplus precipitation, but also to advection of low-salinity water by the coastal current from the nearshore area south of Iceland. Analysis of wind data indicated a close association between the rate of change of the freshwater volume inside the bay between observations and the mean southerly wind component for the same period. This relationship was explained as the result of (1) southerly winds enhancing the transport of freshwater into the bay from the region south of Reykjavik, and (2) wind-driven transport leading to accumulation of freshwater in the bay. Conversely, winds from the north are believed to favor the transport of fresh surface water out of the bay and to suppress the inflow of freshwater by the coastal current from the south. Statistical methods were applied to the quantitative analysis of factors effecting changes in the freshwater content of Faxaflöi. The results strongly supported the view that winds in the N-S direction are a major factor in producing the observed variations in freshwater content. (Sims-ISWS)  
W78-12834

**SUSPENDED SEDIMENT DYNAMICS IN BLUE FJORD, WESTERN PRINCE WILLIAM SOUND, ALASKA.**  
Alaska Univ., College. Inst. of Marine Science.  
C. M. Hoskin, D. C. Burrell, and G. R. Freitag.

Estuarine and Coastal Marine Science, Vol. 7, No. 1, p 1-16, July 1978. 8 fig, 23 ref. NSF 40159X, ERDA AT(45-1)-2229.

Descriptors: \*Alaska, \*Suspended solids, \*Fjords, \*Data collections, Sediment transport, Water circulation, Sedimentation rates, Water temperature, Sampling, Water analysis, Salinity, On-site data collections, Glacial sediments, Sounds, Turbidity, Testing procedures, Water quality, Tidal effects, Glaciers, \*Blue Fjord (Alaska), \*Prince William Sound (Alaska), Sediment traps.

Glacier meltwater and suspended discharge in Blue Fjord occurs over a brief 5-month period in summer. Suspended sediment concentrations in the meltwater stream reach 300 mg/l, and this sediment forms a surface turbid plume at the fjord head. Suspended sediment concentrations in the surface plume range from 200 mg/l at the head to a few mg/l 5 km away at the mouth. Turbidity does not seem to be related to density structure of the water column. Suspended sediment sinks through the water column, with most sediment settling at slack low water. Sediment trap measurements showed an April sediment flux of 1.5 mg dry sediment per sq cm/day at the head and 0.75 mg per sq cm/day at the mouth (mostly diatom frustules). September trap measurements yielded a sediment flux of 53 mg per sq cm/day at the head and 2 mg per sq cm/day at the mouth (mostly detrital inorganic silicates in the mud size range). Bottom sediment in the fjord basin is mostly mud, with an admixture of sand at the fjord head. Grain size modes decrease from an average of 46 micrometers at the head to 8 micrometers 2 km away; no trend is discernable for sediments in the outermost 4 km of the fjord basin. Mud accumulates in the fjord at the rate of about 100 mm/meltwater year at the head, 10 mm/year in mid-fjord, and 4 mm/year in the 190 m basin inside the sill at the fjord mouth. (Humphreys-ISWS)  
W78-12835

**ENERGY BALANCE AND WIND EFFECTS IN A SHALLOW SOUND.**  
Naval Oceanographic Office, NSTL, MS.  
W. E. Hart, and S. P. Murray.  
Journal of Geophysical Research, Vol 83, No C8, p 4097-4106, August 20, 1978. 12 fig, 2 tab, 22 ref.

Descriptors: \*Energy budget, \*Winds, \*Shallow water, \*Coasts, Water circulation, Tidal waters, Currents (Water), Model studies, Mathematical models, On-site investigations, On-site data collections, Energy, Energy transfer, Islands, Barrier islands, Effects, Oceanography, \*Chandeleur Breton Sound, Wind effects.

Tidal energetics and wind effects in an extensive (3000 sq km) shallow (about 3.5 m) sound with two widely separated entrances were studied numerically with a two-dimensional vertically averaged model. A comparison of current predictions with observations from 15 current meter stations under differing tidal regimes proved the reliability of the model. Evaluation of the instantaneous energy balance equation showed the change in energy content to be nearly balanced by input energy flux, frictional energy dissipation being of secondary importance. In contrast to the equipartition of energy in classical long waves, there is on the average 8 times more potential energy than kinetic energy. Input energy flows shows preferential pathways; the wide northern entrance mainly shows energy gain to the Sound, the southern entrance shows equal amounts of gain and loss, while small cuts through the barrier island chain serve mainly as conduits for energy loss. When real tidal input is used, the energy balance time-averaged over a diurnal tidal cycle is not in a steady state, and frictional dissipation is the dominant term. Experiments showed that with winds in the 8- to 9-m/s range, extensive setup can occur (20 cm), strongly dependent on wind direction. Increased speeds through the passages can significantly reduce the residence time in the Sound.

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Saline Water Conversion—Group 3A

Relaxation time of the wind perturbations is only about 3 hours. (Sims-ISWS)  
W78-12845

**MECHANISMS OF HYDROGEN SULFIDE RELEASE FROM COASTAL MARINE SEDIMENTS TO THE ATMOSPHERE.**  
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.  
M. H. Hansen, K. Ingvorsen, and B. B. Jorgensen. *Limnology and Oceanography*, Vol. 23, No. 1, p 68-76, January 1978. 5 fig, 1 tab, 25 ref.

Descriptors: \*Hydrogen sulfide, \*Sediments, \*Coasts, \*Atmosphere, Sampling, Measurement, Biology, Marine biology, Chemistry, Water chemistry, Marine microorganisms, Bacteria, Sulfur bacteria, Sulfates, Oceans, Oceanography, Hydrogen sulfide release.

In two shallow, coastal areas in Denmark the rates of hydrogen sulfide, H<sub>2</sub>S, release were measured directly by continuously collecting the gas over a known area. Peak emission rates of up to 0.30 and 6.7 mmol H<sub>2</sub>S per sq m per h were found with a diurnal average of 0.063 and 1.58 mmol H<sub>2</sub>S per sq m per h. The release mainly takes place at night since photosynthetic microorganisms efficiently oxidize the sulfide during the day. Only traces of H<sub>2</sub>S escape through a stagnant layer ofoxic water 10 cm deep. The rate of H<sub>2</sub>S release was compared to the diurnal changes in light, temperature, Eh, pH, O<sub>2</sub>, and H<sub>2</sub>S at the sediment surface and with the rate of sulfate reduction within the sediment. (Sims-ISWS)  
W78-12848

**TURBULENT FREE CONVECTION IN FRESH AND SALT WATER: SOME CHARACTERISTICS REVEALED BY VISUALIZATION.**  
Washington Univ., Seattle. Dept. of Atmospheric Sciences.  
K. B. Katsaros.  
*Journal of Physical Oceanography*, Vol. 8, No. 4, p 613-626, July 1978. 11 fig, 39 ref. ONR N00014-67-A-0103-0014.

Descriptors: \*Convection, \*Water circulation, \*Laboratory tests, Photography, Tracers, Hydraulic models, Model studies, Turbulence, Turbulent flow, Turbulent boundary layers, Boundary layers, Flow, Freshwater, Saline water, Circulation, Oceanography.

Tracers were used to reveal the motions within the boundary layer on water in turbulent free convection. The technique of obtaining a thin sheet of light with an inexpensive laser and a cylindrical lens was suggested as a convenient tool for classroom demonstrations and research. Some facts about high Rayleigh number free convection, often not revealed by quantitative point sensors, which were illustrated with the accompanying photographs, were as follows: (1) the 'whole' thermal boundary layer at the air-water interface participates in the convection through cyclic instabilities, (2) the form of the convection is predominantly vertical sheets originating from narrow lines in the interface (also observed with 'schlieren' by Spangenberg and Rowland), (3) whether the boundary is rigid or free does not affect the appearance of these lines appreciably, (4) the lines move about in an unpredictable fashion and interact with each other, (5) entrainment away from the boundary very quickly broadens the convection elements, (6) presence of salt strongly affects the horizontal scales of the convection in evaporating water. The latter point also was demonstrated with horizontal wavenumber spectra, and compared to theory. Discussions of similarities between convective systems in atmosphere and ocean and these laboratory observations were included. (Sims-ISWS)  
W78-12856

**WIND-DRIVEN CIRCULATION IN A FJORD.**  
Bergen Univ. (Norway). Geofysisk Inst.  
H. Svendsen, and R. O. R. Y. Thompson.  
*Journal of Physical Oceanography*, Vol. 8, No. 4, p 703-712, July 1978. 14 fig, 3 tab, 16 ref.

Descriptors: \*Water circulation, \*Fjords, \*Winds, Tides, Currents(Water), Water temperature, Salinity, Runoff, Water levels, Stratification, Circulation, Estuaries, Tide waters, On-site investigations, Model studies, \*Norway.

Currents, temperature, salinity, wind, runoff, and water level were observed for a month in the Josenfjord of southern Norway. Tide gauges and currents show little semidiurnal tide. There is a strong diurnal signal in the upper 20 m, which a linear model showed to be caused by the wind. There is a week-long event in which the entire water-mass above the still is flushed out; this is interpreted to be caused by downwelling outside the fjord. The strong stratification near the surface of the fjord greatly modifies the diurnal response of the fjord, but any density-driven mean circulation is at least an order of magnitude smaller than the wind-driven currents. (Sims-ISWS)  
W78-12857

**THE WAVE HEIGHT VARIATION FOR REGULAR WAVES IN SHOALING WATER.**  
Technical Univ. of Denmark, Lyngby (Denmark). Inst. of Hydrodynamics and Hydraulic Engineering.  
I. A. Svendsen, and J. B. Hansen.  
*Coastal Engineering*, Vol. 1, p 261-284, 1977. 12 fig, 4 tab, 21 ref, 1 append.

Descriptors: \*Waves(Water), \*Shoals, \*Beaches, Ocean waves, Model studies, Mathematical models, Variability, Shallow water, Coasts, Laboratory tests, Flumes, Fluid mechanics, Wave heights, Cnoidal waves.

The theory of cnoidal wave shoaling previously has been connected to data in deeper water (described by sinusoidal wave theory) by assuming continuity in energy flux  $E$  sub  $f$  at the matching point between the two theories resulting in a small shift in wave height  $H$  at the matching point. In this paper it was assumed directly continuity in wave height, and tables were given from which the wave height variation can be determined when the wave is specified at any water depth (including deep water). It also was shown that a deep water limit for cnoidal waves exists. The nature of this limit and the behavior of the waves close to it were analyzed. Experimental data for waves with no free second harmonic components were compared with a shoaling model based on linear theory for  $h/L$  sub  $0$  greater than 0.10 and cnoidal theory for  $h/L$  sub  $0$  less than 0.10. The agreement is very good for deep water wave steepnesses  $H$  sub  $0/L$  sub  $0$  up to 3-4%. For larger steepnesses, the linear theory fails to predict the variation for  $h/L$  sub  $0$  greater than 0.10. (Sims-ISWS)  
W78-12864

**FURTHER STUDIES OF PLANKTON ECOSYSTEMS IN THE EASTERN INDIAN OCEAN IV. NUMERICAL TREATMENT IN SITE-SPECIES DATA.**  
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Mathematics and Statistics.  
For primary bibliographic entry see Field 5A.  
W78-12868

**FURTHER STUDIES OF PLANKTON ECOSYSTEMS IN THE EASTERN INDIAN OCEAN VIII. SEASONAL, DIURNAL, AND LATITUDINAL VARIATIONS IN ABUNDANCE OF EUTHECOSOMATA ALONG THE 110 DEGREE E. MERIDIAN.**  
Marine Products Export Development Authority, Calcutta (India).  
For primary bibliographic entry see Field 5C.

W78-12869

**CHLOROPLAST PIGMENTS OF A GREEN PHYTOPLANKTER FROM THE HUDSON ESTUARY, U.S.A.**  
Dalhousie Univ., Halifax (Nova Scotia) Dept. of Oceanography.  
For primary bibliographic entry see Field 5C.  
W78-12884

**DENITRIFICATION OF AMMONIA FORMATION IN ANAEROBIC COASTAL SEDIMENTS.**  
Tokyo Univ. (Japan). Ocean Research Inst.  
For primary bibliographic entry see Field 5C.  
W78-12885

**THE DISTRIBUTION OF NUTRIENTS IN SWARTVLEI, A SOUTHERN CAPE COASTAL LAKE.**  
Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.  
For primary bibliographic entry see Field 5B.  
W78-12889

**LAKE WASHINGTON.**  
Washington Univ., Seattle. Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W78-12907

### 3. WATER SUPPLY AUGMENTATION AND CONSERVATION

#### 3A. Saline Water Conversion

**MOLECULAR BACKWASH FOR DECONTAMINATION OF MEMBRANES.**  
California Univ., Berkeley. Sea-Water Conversion Lab.  
K. S. Spiegler.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 720. Price codes: A03 in paper copy, A01 in microfiche. Completion Report, August 1, 1978. 26 p, 7 fig. OWRD S-0091(7536)(1).

Descriptors: \*Electroosmosis, \*Membranes, \*Molecular backwash, \*Osmosis, Membrane processes.

In studies of osmotic and electroosmotic backwash to decontaminate hyperfiltration membranes, it was found that the direction and magnitude of electroosmotic flow in asymmetric cellulose-acetate membranes in sodium-chloride solutions depends on the concentration of the solutions contacting the membrane. Conclusions from electrochemical evidence indicate that if the solution concentrations are below 0.02 M NaCl, the membranes (cured at 91.5-94°C) are cation selective and above 0.1 M NaCl the membranes are anion selective. It is shown that the friction model of mass transport across membranes can explain reversal of electroosmotic flow, and of membrane selectivity, even in homogeneous membranes. (This is not to mean that theories based on the heterogeneity of asymmetric membranes which take account of the multilayer nature of these membranes are not applicable to such membranes). For 'loose' membranes (i.e. those expanded after curing at 92.5°C), the magnitude of the electroosmotic flux, and its variation with the current density were less than for a 'tight' (unexpanded) membrane cured at the same temperature.  
W78-12101

**PORTABLE WATER DISTILLATION APPARATUS.**  
For primary bibliographic entry see Field 5F.  
W78-12776



## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3A—Saline Water Conversion

**COMMON ION EFFECT TO ASSIST LM SEPARATION,**  
Exxon Research and Engineering Co., Linden, NJ. (Assignee).  
For primary bibliographic entry see Field 5D.  
W78-12781

**END POINT QUALITY CONTROL LIGHT CIRCUIT,**  
Continental Water Conditioning Corp., El Paso, TX. (Assignee).  
For primary bibliographic entry see Field 5G.  
W78-12788

**DESALINATION PROCESS SYSTEM AND BY-PRODUCT RECOVERY,**  
Stone and Webster Engineering Corp., Boston, MA. (Assignee).  
F. E. Conger.  
U.S. Patent No. 4,083,781, 8 p, 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 969, No 2, p 635-636, April 11, 1978.

Descriptors: \*Patents, \*Desalination, \*Water treatment, \*Water purification, Desalination processes, Sea water, Reverse osmosis, Separation techniques, Potable water, Flash distillation, Byproducts.

Known desalination techniques are combined to afford efficient energy usage and to provide by-products which are useful. The system relies essentially on a multi-stage reverse osmosis installation in series with a conventional flash evaporation unit and optionally a brine concentrator. The water to be desalinated is delivered to the first reverse osmosis sub-system, which is a moderate pressure sub-system, by a pump driven by a steam turbine. After passage of the water through the first reverse osmosis sub-system (consisting of one or more stages), both usable product water and salt water of much higher salt content are provided. The reject salt water is then delivered under a higher pressure by a turbine-driven pump to a second reverse osmosis sub-system, which is a high-pressure sub-system (consisting of one or more stages). Again in the second reverse osmosis system, both usable product water and high-salt content water are produced. The high-salt content water is delivered to the evaporation unit for further treatment. Distilled water is recovered by flash evaporation and the high-salt content product remaining is delivered for further process to either concentration ponds (solar ponds) or to mechanical brine concentrators, or to both. Calcium sulfate and sodium chloride are recovered. The process may also produce hydrogen, chlorine and sodium hydroxide.  
W78-12799

**WATER CONDITIONING PROCESS,**  
Rohm and Haas Co., Philadelphia, PA. (Assignee).  
For primary bibliographic entry see Field 5F.  
W78-12800

### 3B. Water Yield Improvement

**PRECIPITATION CLIMATOLOGY FOR THE TEXAS HIGH PLAINS,**  
Texas Tech Univ., Lubbock. Dept. of Geosciences.  
D. R. Haragan.  
The Texas Journal of Science, Vol 30, No 2, p 107-123, 7 fig, 3 tab, 6 ref. (June 1978).

Descriptors: \*Weather modification, Cloud seeding, \*Climatology, \*Precipitation (Atmospheric), \*Texas, Data collections, Variability, \*High Plains (Tex.).

The problem of evaluating cloud-seeding projects has been exacerbated by a lack of adequate statistical data for a quantitative definition of the

natural variability characteristics of the region in question. Quantitative assessment of the spatial and temporal variability of the average (1944-73) precipitation on the Texas high plains is provided to serve as a base for proper evaluation. (Russell-Arizona)  
W78-12221

**WATER RESOURCES IN THE ARID ZONE OF THE USSR AND PROSPECTS OF THEIR UTILIZATION (IN RUSSIAN),**  
L. V. Dunin-Barkovskii.  
Probl Osvo Pustyn 2, p 12-21, 1977.

Descriptors: \*Arid lands, \*Water utilization, \*Moisture availability, \*Water yield improvement, Deserts, Agriculture, Water supply, \*USSR, Agriculture, Asia (Central), \*Deserts.

The desert zone in the USSR (Central Asia) can be exploited more effectively for agricultural development when a sufficient amount of water is available. Ways are presented for improving the water supply in the southern regions.—Copyright 1978, Biological Abstracts, Inc.  
W78-12299

**INTERACTIONS IN WATER RESOURCE DEVELOPMENT,**  
Department of Water Affairs, Pretoria (South Africa).  
For primary bibliographic entry see Field 6D.  
W78-12421

**HAIL DAMAGE TO AGRICULTURE AND ITS PREVENTION,**  
A. E. Carte.  
South African Journal of Science, Johannesburg, Vol 73, No 11, p 327-330, 1977, 14 ref, 7 fig, 3 tab.

Descriptors: \*Hail damage control, Agricultural production, Climatic factors, \*Cloud seeding, Silver iodide, Operations research, \*Weather modification, South Africa.

Bad weather claims about one quarter of agricultural production in South Africa each year, and can be much greater. Drought is the most important single cause of crop losses, yet those due to hail can amount to some R50 million annually. Research directed towards gaining a better understanding of hailstorms is being carried out in a number of countries including South Africa, as are operations to prevent hail damage. The results of the latter are generally controversial and they emphasize the need for further knowledge of hailstorms. (So Afr Water Info Ctr)  
W78-12506

**EVAPORATION CONTROL ON FARM-SIZE RESERVOIRS,**  
Department of Agriculture, Saskatoon (Saskatchewan). Research Station.  
W. Nicholaichuk.  
Journal of Soil and Water Conservation, Vol. 33, No. 4, p 185-188, July-August 1978, 7 fig, 1 tab, 12 ref.

Descriptors: \*Evaporation control, \*Monomolecular films, Water control, Water conservation, Water levels, Water management (Applied), Water shortage, Water yield improvement, Water, Wind velocity, \*Evaporation losses, \*Vapor transport, Vapor pressure gradient, Evaporation rate, Fatty alcohols, Floating cover, Wind action.

The use of monomolecular films reduced evaporation 18% in a field test of several methods of controlling evaporation from a free-water surface in southwestern Saskatchewan, Canada. Although a further evaporation reduction was achieved by combining this treatment with windbreaks and floating grids, the cost of water saved increased.

Rafts proved to be a good alternative to monomolecular films. The most economical raft was made of lightweight concrete, which conserved water at a cost competitive with monomolecular films. Generally, the rafts reduced the depth of ice formation beneath them about 50% compared with areas not covered by rafting material. This was an added benefit apart from evaporation suppression. (Roberts-ISWS)  
W78-12649

**EFFECTS OF FILM ANTITRANSPIRANTS ON WOOD PLANTS (IN RUSSIAN),**  
Moscow Forestry Inst. (USSR).  
V. P. Dadykin, and L. P. Samsonova.  
Fiziol Rast (Moscow) 24(3), p 574-581, 1977.

Descriptors: \*Antitranspirants, Forest management, Acer-negundo, Acer-platanoides, Betula-pendula, Growth rates, Inhibition, \*Methacrylates, Photosynthesis, Populus-deltoides, Populus-pyriformis, Roots, Tilia-cordata, Trees, Organic compounds.

The period of spring foresting can be made longer by employing film antitranspirants prepared on the basis of latex DMMA-65-1-GP (synthetic rubber, butadiene-methyl methacrylate) produced in the USSR. The experiments were conducted with seedlings of birch, linden, maple and poplar (Betula pendula, Tilia cordata, Acer platanoides, A. negundo, Populus pyramidalis and P. deltoides.) The period of spring foresting can be prolonged by 2 wk by means of the antitranspirant. Films of the antitranspirant produced on leaves decrease the rate of transpiration by 30-70% during 8-12 days; during this time, photosynthesis is inhibited by 30-50%, and is then restored to the level of the control. Temporary inhibition of photosynthesis causes changes in the growth rate of plants during the 1st year. The antitranspirant stimulates growth of the root system in the plants.—Copyright 1978, Biological Abstracts, Inc.  
W78-12668

**SUMMARY OF METROMEX, VOLUME 2: CAUSES OF PRECIPITATION ANOMALIES,**  
Illinois State Water Survey, Urbana.  
For primary bibliographic entry see Field 2B.  
W78-12830

**ICEBERGS MIGHT SUPPLY WATER TO ARID REGIONS,**  
Iowa State Univ., Ames.  
C. Herman.  
Irrigation Age, Vol. 12, No. 3, p 42, Nov.-Dec. 1977.

Descriptors: \*Icebergs, \*Melt water, Climatology, Melting, Ice, Ice loads, Arid lands, Sea ice, Fresh water, Water yield.

Two hundred scientists met recently in Ames, Iowa to consider the possibility of using icebergs as a source of fresh water for arid regions. The plan involves transporting the icebergs from Antarctica to water-short areas of the world, melting them once there and using the water for irrigation and drinking water. Icebergs, formed from snow fall 10,000 to 100,000 years ago, contain the purest water on earth and Antarctica, producing more than 10,000 icebergs a year, is considered by scientists to be the source of 90% of the world's fresh water supply. The critical problems discussed at the conference addressed means and methods of harvesting or selecting a proper iceberg, transportation, insulation, and controlled melting at its destination. Towing an iceberg would for instance take 6 months to a year and millions of dollars. Although legal problems are also expected to cause complications, the potential water value of icebergs warrants serious consideration. (Tickes-Arizona)  
W78-12936

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Conservation In Domestic and Municipal Use—Group 3D

**REDUCING PHREATOPHYTE TRANSPIRATION.** California Univ., Davis. Dept. of Land, Air and Water Resources.  
D. C. Davenport, and R. M. Hagan.  
Hydrology and Water Resources in Arizona and the Southwest, Vol. 7, p141-146, 1977. 4 tab, 2 fig, 6 ref.

Descriptors: \*Phreatophytes, \*Transpiration, \*Antitranspirants, \*Transpiration control, \*Chemcontrol, Stomata, Water conservation, Water utilization, Consumptive use, Water yield improvement, Balance of nature, Thin films, Desert plants, Tamarisk, Cottonwoods, Arid lands, Diurnal, Nocturnal.

Phreatophyte vegetation in the semiarid southwest accounts for large water losses through transpiration. Efforts to control this problem through eradication have been shown to cause severe ecological imbalances. This paper examines control efforts with antitranspirants, a technique that avoids removal of vegetation or damage to the environment. In June 1974 cuttings of Saltcedar (*Tamarix pentandra*) and cottonwood (*Populus* sp.) were taken from a single mother plant, rooted and transplanted outdoors in five gallon drums. Irrigation was applied to the soil surface and daily transpiration measurements were recorded by periodic weighing. Two waxbased, food grade antitranspirants were used in these trials: (1) mobileleaf FG (Mobil Chemical Co.) and (2) Foliscote (Crystal Soap and Chemical Co.). These were sprayed on the foliage as emulsions with water by a solo backpack mist blower at various dilutions and application rates. The wax-based antitranspirants increased foliar diffusive resistance and reduced transpiration of saltcedar and cottonwood by 32-38% initially and by 10% after 3 weeks. Antitranspirant effectiveness increased with ratio of day:night hours and with lower soil-water stress. (Tikes-Arizona)  
W78-12939

#### DIURNAL TRENDS IN WATER STATUS, TRANSPIRATION, AND PHOTOSYNTHESIS OF SALT CEDAR.

Idaho State Univ., Pocatello. Dept. of Biology.  
M. E. Williams, and J. E. Anderson.  
Hydrology and Water Resources in Arizona and the Southwest, Vol 7, p 119-124, 1977. 3 fig, 12 ref.

Descriptors: \*Tamarisk, \*Diurnal, \*Consumptive use, \*Water utilization, \*Transpiration control, Moisture uptake, Moisture deficit, \*Photosynthesis, Pores, Respiration, Water loss, Stomata, Lysimeters, Plant physiology.

Saltcedar (*Tamarix chinensis*) is of economic importance in the semiarid southwest not only because it covers 1.3 million acres along permanent and ephemeral waterways but also because of its very high consumptive water use, amounting to over 5 million acre feet per year. Relative water content, water potential, and gas exchange were measured for this shrub at the San Bernado, New Mexico, lysimeter site. Although relative water content and water potential were found to be closely related, water potential measurements using a pressure bomb technique were used more reliably and conveniently. Results obtained under typical summer conditions indicated significant depressions of transpiration and photosynthesis during afternoon hours. This study assessed the diurnal trends to see if these depressions occurred in twigs and photosynthesis were correlated with water stress. Although results indicated that stomatal close-up may be affected by water stress, transpiration and photosynthesis thesis seemed to be unaffected by leaf water status. A diurnal rhythm to control gas exchange is suggested. (Tikes-Arizona)  
W78-12940

### 3C. Use Of Water Of Impaired Quality

**SULFUR ISOTOPE DISTRIBUTION IN SULFATES FROM SURFACE WATERS FROM THE NORTHERN JORDAN VALLEY, ISRAEL.** Weizmann Inst. of Science, Rehovot (Israel). Dept. of Isotope Research.  
For primary bibliographic entry see Field 5B.  
W78-12167

**THE SALT BALANCE OF THE MEXICALI, B.C. IRRIGATION DISTRICT (EL BALANCE DE SALES DEL DISTRITO DE RIEGO DE MEXICALI, B.C.).** Escuela Nacional de Agricultura, Chapingo (Mexico). Dept. of Irrigation and Drainage. O. Palacios Velez, M. Escamilla, and A. Reyes. Natural Resources Journal, Vol 18, p 49-67, January, 1978. 3 ref, English summary.

Descriptors: \*Salinity, \*Saline waters, \*Saline soils, \*Irrigation water, International waters, Mexico, Colorado River, Sampling, Wells.

The fluctuation of salt levels in the Mexicali irrigation district has been under investigation since 1970 in cooperation with technicians from the Secretary of Water Resources. Samples have been taken from more than 50 points at which water enters or leaves the area through canals and drains, as well as from 40 pumping wells considered to be representative of over 700 such wells in the area. Data have been compiled concerning the daily, monthly, and yearly fluctuations in the water's salt content. In addition, yearly soil sampling is carried out to permit evaluation of the impact of salinity fluctuations in incoming and outgoing waters. (Russell-Arizona)  
W78-12226

#### INTERNATIONAL EXTERNAL DISECONOMIES: THE COLORADO RIVER SALINITY PROBLEM IN MEXICO.

Escuela Nacional de Agricultura, Chapingo (Mexico); and Colorado State Univ., Fort Collins. Dept. of Economics.  
For primary bibliographic entry see Field 6E.  
W78-12231

#### RESOURCES DEPLOYED IN WATER RE-USE, Pretoria Univ. (South Africa).

F. A. Van Duuren.  
In: Conference on resources of Southern Africa today and tomorrow, (Johannesburg) South Africa, p 242-250, September 22-26, 1975, 2 fig, 4 tab, 24 ref.

Descriptors: \*Water resources, \*Water reuse, \*Water requirements, Domestic consumption, Agricultural use, Industrial use, Water quality, Water quality criteria classification, Recreational water, Water quality control technique, Water treatment, \*South Africa.

Re-use protects the quality and usefulness of water and increases its availability. A brief review is given of water requirements and demands in South Africa and the consumptive use of water by various industries are tabulated. Then follows the quality of water resources and the quality of water required for various purposes, eg. domestic supply, recreation purposes and for industrial purposes. The measurement of water quality and the classification of water parameters are discussed as well as the methods of purification and treatment. It is concluded that the philosophy and science of systematic water re-use to conserve natural resources, developed and extensively applied in South Africa, may well serve as an example to the better-watered places of the world. (So Afr Water Info Ctr)  
W78-12422

**RELATIONSHIPS BETWEEN SOIL SALINITY AND THE SALINITY OF APPLIED WATER IN THE SUISUN MARSH OF CALIFORNIA.** California State Dept. of Fish and Game, Sacramento. Wildlife Management Branch.  
For primary bibliographic entry see Field 2G.  
W78-12692

**EFFECT OF SALINITY ON AGRICULTURE IN IRAQ.** Mosul Univ. (Iraq). Coll. of Engineering.  
For primary bibliographic entry see Field 5G.  
W78-12922

**IRRIGATING ON THE DEAD LEVEL.** U.S. Water Conservation Lab., Phoenix. L. J. Erie, and A. R. Dedrick.  
Irrigation Age, Vol. 12, No. 3, p 14-15, Nov.-Dec. 1977. 4 photos.

Descriptors: \*Grading, \*Leveling, Saline waters, \*Return flow, Slopes, Labor, Costs, \*Flow control, Water distribution (Applied), Irrigation systems, Irrigation canals, Infiltration, Concrete-lined canals, Dead leveling, Drainage.

The increasing trend in the Southwest to level cropland to zero grade promises to raise crop production, improve irrigation efficiency, and simplify water distribution systems. 'Dead leveling' is one of the measures the ARS is currently pursuing in an effort to reduce return flows to rivers which carry additional salts to downstream water users. ARS researchers using two dead leveled fields of 65 acres each in Arizona have developed automated irrigation systems which when used on dead leveled fields significantly reduce labor costs. An automated jack gate system allows one man to turn large irrigation streams onto a flat field with little difficulty. A piston type air cylinder replaces the gate lifting mechanism and can be activated to open or shut by time clocks. Another system developed to handle large streams is the use of several tile outlets embedded along concrete-lined supply canals. This system utilizes two types of air pillows to close or open the outlets, one containing a valve stem and the other a bellows type similar to those found on the air shocks of large trucks. These systems used on dead leveled fields allow the farmer to get water over the field quickly for even distribution and infiltration at minimal labor cost. (Tikes-Arizona)  
W78-12935

### 3D. Conservation In Domestic and Municipal Use

**ESTIMATING RUNOFF POLLUTION FROM LARGE URBAN AREAS—THE DELAWARE ESTUARY.** Rutgers - The State Univ., New Brunswick, NJ.  
For primary bibliographic entry see Field 5B.  
W78-12111

**A STATISTICAL ANALYSIS OF FACTORS AFFECTING WATER PRICES IN SMALL MUNICIPALITIES.** Mississippi Univ., University. School of Business Administration.  
W. E. Boyet, and K. W. Hollman.  
Current Municipal Problems, Vol. XVII, No. 1, p 16-28, Summer 1975. 2 tab.

Descriptors: \*Statistical methods, \*Pricing, \*Water rates, Mississippi, Regression analysis, Economic efficiency, Planning, Water management (Applied), Equations, Systems analysis.

Water system management and planning present problems of pricing water in the most efficient manner. Mismanagement in water pricing may result in excessive water consumption or in such frugal usage of water that economic development

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3D—Conservation In Domestic and Municipal Use

is stymied. Sound pricing practices that conform to economic ideals have not always been used in the past. It is important that the variables which influence water prices be isolated so that water system managers can determine water prices on a more scientific basis in the future. Described is a study to determine, using multiple regression analysis, the effect that various social, economic, operational, and other types of factors exert on water prices in small Mississippi municipal water systems. A regression equation using these various types of factors was derived to describe water prices. It is found that prices are largely determined on a hit-or-miss basis and that it is only accidental when a particular system establishes a price which conforms to the economic ideal. In conclusion, there is a need for a reevaluation of the pricing practices utilized by the Mississippi water systems which have been studied. (Bell-Cornell)  
W78-12118

**THE ECONOMIC DEVELOPMENT OF TIJUANA IN RELATION TO WATER SUPPLY AND ATMOSPHERIC, MARINE AND AQUATIC CONTAMINATION,**  
Sonora Univ., Hermosillo (Mexico). School of Law and Social Sciences.  
For primary bibliographic entry see Field 6E.  
W78-12227

**CHARACTERIZATION OF URBAN RUNOFF,**  
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.  
For primary bibliographic entry see Field 5B.  
W78-12279

**SOLAR POWER EQUIPMENT FOR DOMESTIC USE.**  
For primary bibliographic entry see Field 3E.  
W78-12431

**EVALUATION OF DETENTION BASINS FOR CONTROLLING URBAN RUNOFF AND SEDIMENTATION,**  
Kentucky Water Resources Research Inst., Lexington.  
For primary bibliographic entry see Field 2A.  
W78-12608

**DISTRIBUTION PATTERNS OF LAWN SPRINKLERS,**  
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.  
G. L. Kerr, L. O. Pochop, J. Borrelli, and D. A. Anderson.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 316. Price codes: A02 in paper copy, A01 in microfiche. ASAE Technical Paper No. 78-2011. 1978. 20 p, 10 fig, 5 tab, 8 ref. Paper presented at 1978 Summer Meeting of American Society of Agricultural Engineers, Utah State U., Logan, Utah, June 27-30, 1978. OWRT B-035-WYO(2), 14-34-0001-7201.

Descriptors: \*Lawns, \*Distribution patterns, \*Sprinkler irrigation, \*Rates of application, \*Water distribution (Applied), \*Water conservation, Water utilization, Municipal water, Christiansen's Uniformity Coefficient (UCC), Overlapped sprinkler patterns, Municipal Water Demand, Lawn appearance.

Distribution patterns of six basic types of lawn sprinklers were determined by testing four sprinklers of each type at three pressure levels. Christiansen's Uniformity Coefficient (UCC) was calculated for the original and nine overlapped watering patterns for each sprinkler tested. The amount of overlap required to achieve minimum acceptable UCC values was then determined.  
W78-12610

**PHOSPHORUS SOURCE MANAGEMENT FOR EUTROPHIC LAKES. PHASE I: TRIBUTARY PHOSPHORUS LOADING,**  
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology; and Rutgers - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.  
For primary bibliographic entry see Field 5B.  
W78-12746

**URBAN STORM-WATER DATA MANAGEMENT SYSTEM, BROWARD COUNTY, FLORIDA,**  
Geological Survey, Bay St. Louis, MS. Water Resources Div. and Geological Survey, Miami, FL. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-12747

**QUALITY AND QUANTITY OF STORM-WATER RUNOFF FROM THREE LAND-USE AREAS, BROWARD COUNTY, FLORIDA,**  
Geological Survey, Miami, FL. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W78-12748

**SUMMARY OF METROMEX, VOLUME 2: CAUSES OF PRECIPITATION ANOMALIES,**  
Illinois State Water Survey, Urbana.  
For primary bibliographic entry see Field 2B.  
W78-12830

**REVIEW OF CANADIAN MUNICIPAL URBAN DRAINAGE POLICIES AND PRACTICES.**  
Gore and Storrie Ltd., Toronto (Ontario).  
For primary bibliographic entry see Field 5G.  
W78-12949

### 3E. Conservation In Industry

**A MODEL FOR SOLAR RADIATION CONVERSION TO ALGAE IN A SHALLOW POND,**  
Purdue Univ., Lafayette, IN. School of Mechanical Engineering.  
F. P. Incropera, and J. F. Thomas.  
Solar Energy, Vol. 20, No. 2, p 157-165, 1978. 14 fig, 2 tab, 30 ref. OWRT A-042-IND(3).

Descriptors: \*Algae, \*Energy conversion, \*Solar radiation, \*Photosynthetic oxygen, Photosynthesis, Chlorella pyrenoidosa, \*Bioconversion, Insolation.

In recent years there has been considerable interest in solar energy utilization through bioconversion, and a promising application involves the mass culture of unicellular algae. The purpose of this study has been to develop systematic procedures for predicting the yield of such cultures as a function of geographic location and diurnal and seasonal conditions. The procedures allow for the use of available insolation data and account for both the spectral and directional characteristics of the incident radiation. Calculations for the maximum hourly production of algae and oxygen have been performed for the Indianapolis, Indiana region, and the results are in reasonable agreement with field data obtained at similar latitudes.  
W78-12270

**ORGANIZATION OF SANITARY PROTECTION OF THE ENVIRONMENT (AIR, WATER BODIES, WATER SUPPLY, SOIL) IN DONETSK (IN RUSSIAN),**  
Donetsk Municipal Sanitation Disinfection Station (USSR).  
For primary bibliographic entry see Field 5D.  
W78-12287

**THE DESIGN AND OPERATION OF A DRY COOLING SYSTEM FOR A 200MW TURBOGENERATOR AT GROOTVLEI POWER STATION; SOUTH AFRICA,**  
N. T. van der Walt, L. A. West, T. J. Sheer, and D. Kuball.  
South African Mechanical Engineer, Johannesburg, Vol. 26, No. 12, p 498-507, 1976. 2 ref, 8 fig.

Descriptors: \*Dry cooling, \*Power generation, \*Cooling towers, \*Design criteria, Water saving, Atmospheric conditions, Humidity, Wind velocity, Climatic factors, \*Performance, Experimental results, Grootvlei Power Station, \*South Africa.

A large dry-cooling system for a 200 MW turbo-generator was commissioned in South Africa in 1971. One of the aims in installing this system was to gain design and operating experience of dry cooling systems. The cooling system is of the indirect type, with a jet condenser. For economic reasons a natural-draught cooling tower was selected, within which the finned-tube cooling elements are mounted horizontally. The design heat rejection for the non-reheat turbine is 1 191 GJ/h. The overall height of the cooling tower is 100m. The design ambient conditions include an average dry-bulb air temperature of 15.6 degrees C, an annual temperature variation from 5 degrees C, to 35 degrees C and an atmospheric pressure of 846 mb (station elevation being 1 700 m above MSL). The commissioning of this installation is described, as well as some aspects of the first two years of operation, including spray condenser performance, condensate treatment, investigations into corrosion and fouling of the cooler tubes, waterhammer problems, and operator experience. Performance testing has been carried out, and has included the continuous monitoring of condensate and air temperatures over 24h periods. These tests have revealed variations in the heat transfer capability of the tower, over and above the expected variations associated with change in ambient temperature. This additional variation in performance is due to the influence of the total atmospheric environment on the draught through the tower. Change in the wind velocity at the top of the tower and in wind and temperature gradients in the vicinity of the tower are factors to which the variations are attributed. The cooling system has functioned very successfully to date, with practically 100 per cent availability of the cooling tower. In the dry and substantially pollution-free conditions generally encountered inland in South Africa, there seems no reason to doubt that long and troublefree operating lives of dry-cooling towers can be achieved. (So Afr Water Info Ctr)  
W78-12389

**COST OF HOT WATER SUPPLY REDUCED BY SOLAR HEATING,**  
For primary bibliographic entry see Field 6C.  
W78-12391

**REUSE FOR SURVIVAL,**  
For primary bibliographic entry see Field 5E.  
W78-12405

**POWER STATION EFFLUENT CONTROL AND THE REUSE OF ASH WATER FOR COOLING WATER TREATMENT,**  
For primary bibliographic entry see Field 5F.  
W78-12417

**SOLAR POWER EQUIPMENT FOR DOMESTIC USE.**  
Development Magazine, Vol. 11, No. 10, p 67, 71-72, 1977.

Descriptors: \*Domestic water, \*Solar energy, Solar heating, Geysers, Water pressure, Temperature fluctuations, Economics, Equipment descrip-



## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Conservation In Agriculture—Group 3F

tion, Solar radiation, \*Rhodesia, \*Southern Africa.

Discussion is presented of the production of domestic solar water heaters in Rhodesia and the installation of a number of large units at schools and hostels. One of the problems that appeared was the need to educate users. With solar heaters, there is no progressive cooling and taps tend to be left running. Consequently, storage which should be sufficient for three to four days is often run off in one day. Various types of collectors are discussed as well as a solar cooker which can reach temperatures in excess of 180 degrees centigrade. (So Afr Water Info Ctr)  
W78-12431

**ENVIRONMENTAL POLLUTION CONTROL ON MINES,**  
For primary bibliographic entry see Field 5G.  
W78-12439

**PLUGGING IN TO THE BIG DYNAMO,**  
Council for Scientific and Industrial Research Pretoria (South Africa).  
W. N. Cawood.  
Scientiae pretoria. Vol 18, No 1, p 2-11, 1977. 7 refs.

Descriptors: \*Solar energy, Steam turbines, Pumped storage, Domestic water, Solar heating, Agriculture, Swimming pools, Solar stills, Research and development, \*South Africa.

While the world worries about dwindling fossil fuel reserves a virtually limitless energy source blazes away in the sky. Discussion is presented of the harnessing of solar energy and mentions solar research, photothermal processes, photovoltaic processes, domestic water heating, space heating, agricultural applications, swimming pool heating, cooking, solar stills and commercial and industrial uses. (So Afr Water Info Ctr)  
W78-12445

**THE DESIGN AND OPERATION OF A DOUBLE-COMPARTMENT VERTICAL FLOW SETTLER,**  
B. N. Souter.  
Journal of the South African Institute of Mining and Metallurgy, Vol 77, No 8, p 163-174, 1977. 4 tab, 19 figs.

Descriptors: \*Vertical flow tanks, \*Settling basins, Underground treatment plants, Pumping stations, Mines, Mine water, Filtration, Grit removal, \*South Africa.

The development is described of a vertical-flow settler for underground pumping installations in the mines of Gold fields of South Africa Ltd. The recommended settler employs the principle of 'dynamic filtration': the solids that are in suspension in mine water are filtered through a stable horizontal bed of flocculated particles, a technique that was established in about 1958. (So Afr Water Info Ctr)  
W78-12455

**EVAPORATION: SOME PROBLEMS AND THEIR SOLUTIONS,**  
J. W. Cole.  
Certificated engineer, Johannesburg, Vol 50, No 9, p 124-126, 1977. 3 fig.

Descriptors: \*Evaporation, Fouling, Corrosion, Energy costs, Sensitivity, Falling film evaporation, Evaporators, Equipment, South Africa.

The author examines some of the problems inherent in the evaporation process, with particular attention to fouling, corrosion, energy-saving and the treatment of heat-sensitive products. He describes how modern technology can help to solve them. (So Afr Water Info Ctr)

W78-12458

**SOME ASPECTS OF ENERGY AND THE ENVIRONMENT IN THE STEEL INDUSTRY,**  
For primary bibliographic entry see Field 5G.  
W78-12460

**THE FUTURE OF ENERGY IN SOUTHERN AFRICA,**  
R. K. Dutkiewicz.  
Rhodesia Science News, Salisbury, Vol. 10, No. 3, p 73-77, 1976. 7 ref, 3 tab.

Descriptors: \*Energy sources, Hydroelectric power, Coals, Oil shales, Crude oil, Gas, Oil industry, Solar energy, \*Southern Africa, Sasol, Kariba, Cabora Bassa.

Over the last few years the energy scene has been drastically altered by two happenings - firstly, the Oil Producing and Exporting Countries (OPEC) unilaterally increased the price of oil by a factor of four - and secondly, the Club of Rome issued two reports, the first 'Limits of Growth' by Meadows in 1972, the second, that of Professors Mesarovic and Pestel published in 1974 and called 'Mankind at the Turning Point.' The oil price rise, coming as it has at a difficult time of the world's economy has placed a large burden on the economies of many countries, especially the developing countries where the secondary effect of the oil price increase, such as the effect on fertilizer prices, has affected the country's ability to support themselves. Southern Africa must increase its hydroelectric usage to the maximum both for economic and environmental reasons it will, however, remain very reliant on coal reserves and the bulk of the sub-continent's energy, mainly consumed in South Africa, will continue to be dominated by coal well into the next century. By that time there will be an increasing reliance on nuclear power, again in South Africa, the other countries continuing to rely heavily on hydropower. South Africa, the other countries continuing to rely heavily on hydropower. On the far horizon, there is the possibility of fusion power, leading to almost limitless energy resources and possibly an increasing reliance on solar power. (So Afr Water Info Ctr)  
W78-12499

**GROUND-WATER USE FOR NUCLEAR POWER PLANTS,**  
Bechtel, Inc., Gaithersburg, MD.  
E. M. Smith.  
Ground Water, Vol 16, No 5, p 352-354, September-October 1978. 1 fig, 2 tab, 3 ref.

Descriptors: \*Groundwater, \*Water resources, \*Nuclear powerplants, Water supply, Water sources, Water demand, Surveys, Cooling water, Construction, Powerplants, Electrical Powerplants.

The uses of water for nuclear power plants consist of the following: service water, emergency cooling water, domestic (potable, sanitary), construction, and fire fighting. The quantity of water for these various uses may range from 10 gpm (0.63 l/s) for domestic supplies to greater than 100,000 gpm (6309 l/s) for service water and emergency cooling water supplies. Historically, the source of a water for nuclear power plant use has been surface water bodies, such as rivers, lakes, oceans, and man-made canals. Groundwater sources have supplied relatively small quantities of water for plant use, mainly domestic and construction supplies. A survey of 123 nuclear power plant sites which are either built, under construction, or planned, revealed that about 3% of all plant water supplies is derived from groundwater sources. Presently, 4 nuclear power plants intend to use groundwater in relatively large quantities (as service water and emergency cooling water). Two of these plants will use groundwater via induced infiltration from radial collector wells, and the other two plants intend

to withdraw groundwater from deep wells (1,000 feet) from a confined aquifer. Another plant, under construction, intends to use sewage effluent which is originally derived from a combination of surface and groundwater. (Sims-ISWS)  
W78-12844

**DEWATERING ALTERNATIVES FOR POTATO WASTES, A PRELIMINARY STUDY,**  
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.  
For primary bibliographic entry see Field 5D.  
W78-12951

### 3F. Conservation In Agriculture

**TRICKLE IRRIGATION IN MICHIGAN FRUIT PLANTINGS,**  
Michigan State Univ., East Lansing. Dept. of Horticulture.  
A. L. Kenworthy.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 892, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, submitted to the Institute of Water Research, Michigan State University, East Lansing, June, 1978. 13 p, 6 fig, 1 tab, 16 ref. OWRB-029-MICH(1), 14-31-0001-3899.

Descriptors: Irrigation, \*Trickle irrigation, Water application, \*Orchards, \*Michigan, Fruit crops, Crop production, Traverse County(Mich), Leelanau County(Mich), Ottawa County(Mich).

Research plots were established on apple, peach, plum, and sour cherry plantings in Grant Traverse County; on sour cherry, sweet cherry and plum in Leelanau County; and on blueberry in Ottawa County. Water application rates were 0, 0.5, 1.0, and 2.0 gallons of water per hour per tree in 1973 and 1974. In 1975 and 1976 the rate was 0, 1.0, 2.0 and 4.0 gph per tree. Duration of irrigation varied with tree size. In 1975, all plots (except blueberry) were subdivided for different rates of nitrogen application through the trickle system. Nitrogen was applied to equal 100%, 50% and 25% of grower applications. Applications through the trickle system were in four equal amounts at weekly intervals in June. Yield responses indicated that a rate of 2.0 gph was best for all apple cultivars except R. I. Greening, which showed the best response at 4.0 gph. Increase in yield with increased amounts of water was not significant for sour cherry, significant for peach, while plum, sweet cherry and blueberry showed no increase. Nitrogen applications test results indicated that the amount of nitrogen could be reduced 50% if applied through the trickle system in June.  
W78-12106

**MAXIMUM NONEROSIVE FURROW IRRIGATION STREAM SIZE,**  
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.  
For primary bibliographic entry see Field 4D.  
W78-12143

**ISLAMIC WATER LAW WITH SPECIAL REFERENCE TO OASIS SETTLEMENT,**  
Oxford Univ. (England). School of Geography.  
For primary bibliographic entry see Field 6E.  
W78-12212

**ESTIMATION OF WATER PRODUCTION FUNCTIONS FOR EVALUATION OF IRRIGATION METHODS: A CASE STUDY IN CHILE,**  
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.  
L. L. Parks.  
Interiencia, Vol 3, No 2, p 79-86, March-April, 1978. 4 tab, 2 fig, 8 ref.

### Group 3F—Conservation In Agriculture

Water scarcity and lack of funds to invest in large-scale irrigation projects will force some Latin American countries to use existing water resources more efficiently to increase crop production. Water use efficiency is determined here as the 'water production function', which expresses crop yield as a function of water quantity. The objectives of this study were to estimate (1) the shapes of water production functions for selected crops, (2) the magnitudes of differences in crop yields and water application between experimental farms and actual farms, and (3) the economic value of adopting improved irrigation technology. The general conclusions were that water production functions are useful in analyzing the efficiency of water use and that adoption of improved irrigation technology in the study area would increase economic gains significantly. (Russell-Arizona)

W78-12720

**A REPORT ON THE TRANSKEIS FIFTY MILLION RAND IRRIGATION SCHEME.**  
Civil Engineering contractor (Johannesburg) Vol.  
10, No. 6, p 15-18, 1976.

A sophisticated R50m scheme is underway in the Transkei to help the Xhosa nation to an economic viability when it gains its independence. Mention is made of the construction and lining of the canals which will transport the water needed to irrigate 200 Ha of the Ncora flats in North Western Transkei. (So Afr Water Info Ctr)  
W7R.12416

**Descriptors:** \*Water requirements, \*Crop production, Irrigation, Evapotranspiration, Soil moisture, \*Crop yield, Capillary water, Water loss, Evaporation, Transpiration, Lysimeter, \*Sugarcane, South Africa.

**PIPE DREAM COMES TRUE,**  
S. Fiske.  
Farmer's Weekly, December 22, p 30-31, 1976.

The microjet system of irrigation has its main appeal in the advantages to be gained from economies in the use of water and of labour. The cost of installation is usually cited as the major disadvantage. The article points out that the high capital cost can be partially recouped if fertilizers and herbicides can be pumped through the same nozzles. The CSFRI at Nelspruit have been experimenting with various chemical weedicides on fruit-trees which are watered by microjet. The spraying pattern of the microjets ensures that very little of the spray actually comes into contact with the trees. (So Afr Water Info Ctr) W78.12434

Descriptors: \*Flood plains, \*Flood damage, \*Sugarcane, Crop production, Rainfall, \*Zululand, Umflozi flats, Nkweleni River, Umhlatazi valley. South Africa.

The January 1977 floods are described, in Zululand in which cane growers lost approximately R7000 000 in overall damage. The flood damage in the Nkweleni Valley, the Umfolozi flats and the Umhlutazi Valley was serious and the Nkweleni River and tributaries rose to levels unprecedented in living memory. (So Afr Water Info Center). W78-12440

**IRRIGATION OF SUGAR CANE, PART TWO,**  
G. D. Thompson.  
South African Sugar Journal, Durban, Vol 61, No  
4, p 161-174, 1977, 74 refs, 5 tabs.

**Descriptors:** \*Irrigation, \*Sugarcane, \*Drip irrigation, \*Crop irrigation, Applications, Soil types, Soil water plant relationships, Surface irrigation, Spray irrigation, Impervious soils, Frequency distribution, Soil moisture meters. \*South Africa.

Part two compares in depth the various methods of irrigation of sugarcane namely surface, sprinkler and drip irrigation techniques. Other considerations which are mentioned include Burning versus trashing; supplementary irrigation in summer only and frequency of irrigation. The author next discusses irrigation and crop characteristics which includes Harvestable stalk populations; mean weight per stalk; harvested stalk length; stalk diameters; lodging; and flowering. Attention is also paid to irrigation control and the drying off period. (So Afr Water Info Ctr)  
W78-12453

**CORN YIELD - AN EARLY WARNING SYSTEM,**  
For primary bibliographic entry see Field 2B.  
W78-12471

**DIMETHOATE APPLIED BY MICROJET AND DRIP IRRIGATION FOR CONTROL OF CITRUS PSYLLA, TRIOZA ERYTREAEE TRIOZA ERYTREAEE, THE VECTOR OF GREENING DISEASE,**  
D. L. Milne, and G. A. de Villiers.  
Citrus and Subtropical Fruit Journal, No 525, p 15-17, 1977. 7 ref. 4 tab. 1 fig.

**Descriptors:** \*Dimethoate, \*Microjets, \*Drip irrigation, Citrus Psylla, Trioza Erytreae, Pest control, Plant pests, Crop production, pesticide residues, Insects, Toxoptera, Aonidiella, \*South Africa

Soil systemic pesticides have recently been used to obtain control of trips on citrus. In the present trial, use was made of microjet and drip irrigation systems for the application of dimethoate (Perfekthion 40% EC) to control citrus psylla on 7-year old trees. Effective control was obtained for more than seven weeks with a single application. Two applications gave seasonlong protection and residues were well below the accepted maximum permissible levels. Suppression of the black citrus aphid, *Toxoptera citricidus*, and red scale, *Aonidiella Aurantii*, were also obtained. (S. Afr Water Info Ctr) W78-12473

**HAIL DAMAGE TO AGRICULTURE AND ITS PREVENTION,**  
For primary bibliographic entry see Field 3B.  
W78-12506

**DISTRIBUTION PATTERNS OF LAWN SPRINKLERS,**  
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 3D.  
W78-12610

**POLICIES, ISSUES AND CONCERNS OF  
WATER AND RELATED LAND RESOURCES  
INTEREST GROUPS,**  
Kansas Water Resources Board, Topeka.  
For primary bibliographic entry see Field 6E.  
W78-12619

**COMPREHENSIVE BASIN STUDY, RED RIVER  
BELOW DENISON DAM, ARKANSAS, LOUISIANA,  
OKLAHOMA, TEXAS. VOL. 4, APPENDIX VI:  
IRRIGATION; APPENDIX VII: DRAINAGE AND  
FLOOD PREVENTION ON FLATLANDS.**  
For primary bibliographic entry see Field 6B.  
W78-12763

**BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY. VOLUME II, ANNEX A: AGRICULTURAL REQUIREMENTS AND UPSTREAM WATERSHED DEVELOPMENT.**  
For primary bibliographic entry see Field 6B.  
W78-12769

**CONTROL VALVE AND SPEED ADJUSTMENT  
FOR WATER DRIVE IRRIGATION SYSTEM,**  
Heinzman Engineering, Inc., Grand Island, NE.  
(Assignee).  
J. C. Groelz.  
U.S. Patent No. 4,080,991, 10 p, 8 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 968, No. 4, p 1336, March 28, 1978.

**Descriptors:** \*Patents, \*Irrigation, \*Irrigation systems, \*Irrigation efficiency, Flow control, Remote control, Application equipment, Valves.

A control valve for use in conjunction with the control system of water powered flood irrigation equipment has a valve housing provided with an inlet opening, and outlet opening, and a flow passage connecting them. The flow path is selectively blocked and unblocked by a valve element actuated by a pilot valve controlled remotely by an operator of the equipment in order to determine the direction of rotation of a drive motor which propels a portion of the equipment about a pivot axis as a function of the position of other portions of the equipment. A fluid actuated motor provided with an eccentrically mounted output cam permits control of the time the end unit of the equipment, which unit controls the operation of other units placed between the end unit and the pivot axis is on and off in order to obtain a continuous speed control of the equipment. (Sinha-OEIS) W78-12774

A water-driven system is designed to pump water in the event a pivot is used. The system is used in towers about 100 ft high. W78-12797

**STRAW-MULCHING AND  
WATER STORAGE**  
Southwestern  
Bushland, Texas  
P. W. Unger  
Soil Science  
No. 3, p 486  
ref.

**Descriptors:** storage, \*O  
**Precipitation**  
content, Ru  
conservation  
lowing, Dry  
Straw mulc  
content.

A field study of the effects of straw mulch during fallow on wheat production. The treatments were 4, 8, or 12 mm straw mulch in July 1978 compared with previously bare fallow each year. The wheat and soil water content in July until the straw was planted the next season. Average rainfall was 12.3 and 21.5 mm. Mulch treatment water, along with evaporation, increased grain yields and water use for the response. The response increased by 115.0 kg/ha (1.5 t/ha) (ISWS) (W78-12855).

**VARIABLES  
SEDIMENT  
OKLAHOMA**  
Agricultural  
Quality Ma  
For primar  
W78-12858

**WATER TREATMENT SYSTEMS**  
Agricultural  
Water Con  
For primar  
W78-12920

**PROTECT  
WIND AND  
Soil Conser  
Technical  
B. L. Maus  
Soil Conser  
1977, 5 pho**

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Control Of Water On The Surface—Group 4A

**WATER DRIVE SYSTEM FOR A MOBILE AGRICULTURAL IRRIGATION UNIT,** Lindsay Mfg. Co., Lindsay, NE. (Assignee). R. H. Stearns. U.S. Patent No. 4,083,378, 6 p, 2 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 969, No 2, p 501, April 11, 1978.

Descriptors: \*Patents, \*Irrigation, \*Irrigation systems, \*Irrigation efficiency, Water conveyance, Conveyance structures, Water utilization.

A water-driven unit for a center pivot irrigation system is described in which the pressure of the water in the pipe extending out from the center pivot is used as the motive force for moving the towers about the center pivot. (Sinha-OEIS) W78-12797

**STRAW-MULCH RATE EFFECT ON SOIL WATER STORAGE AND SORGHUM YIELD,** Southwestern Great Plains Research Center, Bushland, TX. P. W. Unger. Soil Science Society of America Journal, Vol. 42, No. 3, p 486-491, May-June 1978. 4 fig, 3 tab, 12 ref.

Descriptors: \*Mulching, \*Soil water, \*Water storage, \*On-site investigations, \*Great Plains, Precipitation (Atmospheric), Infiltration, Moisture content, Runoff, Crops, Grain sorghum, Water conservation, Arid lands, Semiarid climates, Fallowing, Dry farming, Crop response, Agriculture, Straw mulch, Precipitation storage, Soil water content.

A field study was conducted to determine the effects of straw mulch rates on soil water storage during fallow and on subsequent grain sorghum production. Wheat straw at rates of 0 (check), 1, 2, 4, 8, or 12 metric tons/ha was placed on field plots in July 1973, 1974, and 1975. A different area, previously cropped to dryland wheat, was used each year. Atrazine was applied for volunteer wheat and weed control before mulch placement. Soil water content was measured periodically from July until the following May, when grain sorghum was planted, and during the sorghum growing season. Available soil water at planting averaged 12.3 and 21.4 cm for the 0- and 12-metric tons/ha mulch treatments, respectively. The additional water, along with greater infiltration and lower evaporation during the growing season, increased grain yields, which averaged 1,780 and 3,990 kg/ha for the respective treatments. Water-use efficiency increased from 55.6 kg/ha-cm for no mulch to 115.0 kg/ha-cm for 12 metric tons mulch/ha. (Sims-ISWS) W78-12855

**VARIABILITY OF ANNUAL NUTRIENT AND SEDIMENT DISCHARGES IN RUNOFF FROM OKLAHOMA CROPLAND AND RANGELAND,** Agricultural Research Service, Durant, OK. Water Quality Management Lab. For primary bibliographic entry see Field 5G. W78-12858

**WATER TREATMENTS IN TRICKLE IRRIGATION SYSTEMS,** Agricultural Research Service, Phoenix, AZ. Water Conservation Lab. For primary bibliographic entry see Field 5G. W78-12920

**PROTECTING THE GREAT PLAINS FROM WIND AND DROUGHT,** Soil Conservation Service, Lincoln, NE. Midwest Technical Service, Center. B. L. Maus. Soil Conservation, Vol. 42, No. 11, p 5-7, June, 1977. 5 photos.

Descriptors: \*Water conservation, \*Soil conservation, \*Erosion control, Land management, Pasture management, Range management, Wind erosion, Windbreaks, Droughts, Moisture stress, Great Plains, Water yield improvement, Irrigation water, Soil Conservation Service.

The history and development of the 21 year old Great Plains Conservation Program (GPCP) are reviewed. Designed in the early 1950s with the purpose of solving problems resulting from drought and cultivation of land unsuited for sustained crop production, this program became law in 1956. The program is administered by the Soil Conservation Service through local districts and gives aid to ranchers and farmers to make needed adjustments in land use and to install conservation measures. Benefits of the programs have included reduced wind and water erosion, increased water for livestock, savings in irrigation water, and improved range and cropland. (Tickes-Arizona) W78-12923

**TEXAS RANCHER PROSPERS DESPITE DROUGHT,** Soil Conservation Service, Washington, DC. Information Div. S. F. Fields. Soil Conservation, Vol. 42, No. 11, p 8-9, June 1977. 2 photos.

Descriptors: \*Droughts, \*Grazing, \*Range management, Browse utilization, Brush control, Carrying capacity, Range grasses, Soil conservation, Water conservation, Texas.

A Texas rancher has been fighting drought successfully since 1975 by following a ranch conservation plan under the Great Plains Conservation Program (GPCP). Proper grazing management has made it possible to water and feed his 750 head of cattle on 5,500 acres near Canadian, Texas, despite the drought that has besieged this area. Critical factors affecting the flexible grazing system used are time and amount of rainfall, forage growth, brush spraying, and sparseness or proliferation of brush. Aid from the GPCP and the Salt Fork Soil and Water Conservation District has made it possible to dig water wells and establish water storage facilities to supplement a regular program of brush spraying and grass seeding. (Tickes-Arizona) W78-12930

**THE GREENING OF THE DESERT: WHAT COST TO FARMERS.,** B. E. Worthington. Civil Engineering, August, 1978, Vol. 48, No. 8, p 60-63. 3 fig.

Descriptors: Dams, \*Irrigation programs, \*Environmental effects, \*Social impact, Irrigation systems, Land reclamation, Social adjustment, Social values, Social participation, Water resources planning, Project planning, Estimated benefits, Project post-evaluation, Public health, Epidemics, Environmental sanitation, Human disease, Egypt, Sudan, Iran, Developing countries.

Irrigation projects planned and built on large scale can contribute much to the agricultural and economic output of developing arid countries. Often however social and health problems are created by these projects that outweigh the positive benefits. While engineers understand the technical aspects of such projects, planners must consider the whole spectrum of influences these projects create. Three case studies are used here to illustrate this point. High Dam in Egypt was completed in 1970 and has created a million acres of new irrigated land, however, also created is the spread of the serious disease Schistosomiasis (Bilharzia) to epidemic proportions along the canals and the need to feed large number of domestic animals required to lift and transport the water. In Sudan, the Khasham-el-Girba dam

scheme has caused the traumatic resettlement of two different ethnic groups into the same area. Both nomads and dry land farmers in this country depend upon observation and prediction of nature in making critical decisions. The resulting social as well as disease-related problems caused by the new dam have driven many from the area. In Iran the DEZ Irrigation Project has shown that increased agricultural production is often at odds with socio-economic development in this traditional country. (Tickes-Arizona) W78-12932

**SELECTED IRRIGATION RETURN FLOW QUALITY ABSTRACTS, 1975, FIFTH ANNUAL ISSUE,** Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering. For primary bibliographic entry see Field 5G. W78-12933

**RESPONSE TO DROUGHT,** Institute for Water Resources (Army), Fort Belvoir, Va. For primary bibliographic entry see Field 6B. W78-12943

## 4. WATER QUANTITY MANAGEMENT AND CONTROL

### 4A. Control Of Water On The Surface

**ESTIMATING RUNOFF POLLUTION FROM LARGE URBAN AREAS--THE DELAWARE ESTUARY,** Rutgers - The State Univ., New Brunswick, NJ. For primary bibliographic entry see Field 5B. W78-12111

**LOCATING DRAINAGE SYSTEMS BY MAGNETOMETER SURVEYS,** Toledo Univ., OH. Dept. of Geology. For primary bibliographic entry see Field 8G. W78-12142

**GENERATION OF SKEWED ANNUAL FLOWS USING FAST FRACTIONAL GAUSSIAN NOISE GENERATOR,** Monash Univ., Clayton (Australia). Dept. of Civil Engineering. For primary bibliographic entry see Field 2E. W78-12146

**SERIALLY LINKED RESERVOIR SYSTEM DESIGN USING STOCHASTIC PROGRAMMING,** Magyar Tudományos Akademia, Budapest. A. Prekopa, T. Rapcsák, and I. Zsuffa. Water Resources Research, Vol. 14, No. 4, p 672-678, August 1978. 5 fig, 1 tab, 10 ref, 1 append.

Descriptors: \*Reservoirs, \*Rivers, \*Model studies, \*Mathematical models, Flow, Storage, Inflow, Discharge (Water), Overflow, Mathematics, Stochastic processes, Hydrology, \*Hungary.

A stochastic programming model formulated for a serially linked reservoir system design was presented, and a numerical solution method was proposed. The model already has been formulated in a concise form. Here a more detailed explanation was given, the sequential unconstrained minimization technique for the solution of the optimization problem was applied, and a numerical example was presented. The example was taken from a large model which arose in the first implementation of this reservoir system design method in practice. (Sims-ISWS) W78-12147



## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

**EXPECTED VALUE OF ASYMPTOTIC MAXIMUM DEFICIT FOR PERIODIC-STOCHASTIC INFLOWS OF FULL-FLOW REGULATION,** Engineering Consultants, Inc., Denver, CO. K. N. Mutreja, and V. Yevjevich. *Journal of Hydrology*, Vol. 38, No. 1/2, p 113-123, July 1978. 4 fig, 3 tab, 4 ref. NSF ENG74-17396.

**Descriptors:** \*Reservoir storage, \*Storage capacity, \*Model studies, Mathematical models, Reservoirs, Regulated flow, Inflow, Discharge(Water), Storage, Stochastic processes, Analytical techniques, Hydrology.

An analytically derived expression is not available for the exact expected maximum deficit of periodic-stochastic net inflows in the case of full-flow regulation because of the complexities involved. Maximum deficit was defined as the storage capacity needed to supply water for a constant outflow (equal to or smaller than the total output mean) for a given sample size. Its properties were developed by using the method of generation of new samples. It was found that the expected asymptotic maximum deficit of periodic-stochastic net inflow (inflow minus outflow) for the full-flow regulation can be obtained by adding the storage required by the periodicity in the input and output means to the storage required by the stochastic component multiplied by the periodic standard deviation. The storage required by the periodicity in the means was approximated by a constant. (Sims-ISWS)  
W78-12150

**GENERATING STREAMFLOW SEQUENCES WITH TREND AND CYCLICAL MOVEMENTS,** Florida Univ., Belle Glade. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 2E.  
W78-12157

**INSTITUTIONS FOR THE SOLUTION OF SURFACE WATER PROBLEMS BETWEEN MEXICO AND THE UNITED STATES (INSTITUCIONES PARA LA SOLUCION DE PROBLEMAS DE AGUAS DE SUPERFICIE ENTRE MEXICO Y LOS ESTADOS UNIDOS),** Instituto Mexicano de Estudios Diplomáticos.  
For primary bibliographic entry see Field 6E.  
W78-12234

**STREAMFLOW REGIONALIZATION IN BRITISH COLUMBIA, NO. 4 REGRESSION OF LOW FLOWS ON PHYSIOGRAPHIC PARAMETERS,** Department of the Environment, Vancouver (British Columbia). Inland waters Directorate (Pacific Region).  
For primary bibliographic entry see Field 2E.  
W78-12257

**EVALUATION OF DRAINAGE - WATER TABLE CONTROL SYSTEMS USING A WATER MANAGEMENT MODEL,** North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering. R. W. Skaggs.  
Paper No. 77-2030, presented at Annual Meeting of ASAE, St. Joseph, Missouri, June 1977, 8 p, 10 fig, 2 tab, 29 ref. OWRT A-083-NC(3), 14-34-0001-7070.

**Descriptors:** \*Drainage control, Water movement, Surface waters, Irrigation waters, Model studies, Management, \*Coastal plain soils, \*North Carolina.

A water management model was used to continuously simulate the soil water regime over a 20-year period for alternative designs of drainage and water table control systems for two soils. Water management systems consisting of surface and subsurface drainage, controlled drainage and sub-

irrigation were considered in the analysis. The systems were evaluated in terms of their effect on trafficable conditions for seedbed preparation in the spring, adequate drainage for crop growth during the growing season and number of dry days during the growing season. The results are presented on the basis of a five-year recurrence interval. It was found that a 43 m drain spacing will satisfy conventional drainage requirements for the Wagram soil. Closer spacings are not desirable as they will increase soil water deficiencies during dry years unless water table control practices are used. Drain spacings required for the Bladen soil varied from 12 to 20 m depending on the quality of surface drainage. Subirrigation can be used to good advantage on the Wagram soil with a 30 m drain spacing and good surface drainage but was found to be infeasible for the tight Bladen soil. (Kiger-NC State)  
W78-12274

**SOLVING THE PIPE NETWORK ANALYSIS PROBLEM USING OPTIMIZATION TECHNIQUES,** Southern Methodist Univ., Dallas, TX.  
For primary bibliographic entry see Field 8B.  
W78-12285

**MICROBIOLOGICAL STATE OF THE KIEV RESERVOIR IN THE SIXTH-SEVENTH YEARS OF ITS EXISTENCE (IN RUSSIAN),** Akademiya Nauk URSS, Kiev. Instytut Hidrobiologii.  
For primary bibliographic entry see Field 5B.  
W78-12297

**WATER RESOURCES IN THE ARID ZONE OF THE USSR AND PROSPECTS OF THEIR UTILIZATION (IN RUSSIAN),** For primary bibliographic entry see Field 3B.  
W78-12299

**ANALYTICAL FRAMEWORK FOR THE DESIGN OF DATA COLLECTION SYSTEMS THAT ARE RESPONSIVE TO THE NEEDS OF PLANNING AND MANAGEMENT OF WATER RESOURCES AND RELATED LAND SYSTEMS,** Case Western Reserve Univ., Cleveland, OH. Systems Engineering Div.  
For primary bibliographic entry see Field 6A.  
W78-12388

**A COMPARISON BETWEEN A MONTHLY SIMULATION AND AN ANNUAL MORAN MODEL OF VAAL DAM,** Natal Univ., Durban. C. G. Pergam.  
Civil Engineer in South Africa, (Johannesburg), Vol. 18, No. 6, p 131-133, 1976. 10 ref, 2 fig.

**Descriptors:** \*Mathematical models, \*Moran model, Reservoirs, \*Model studies, Simulation analysis, Evaporation, Parameters, Hydrology, Vaal Dam, South Africa.

Among methods used to analyse reservoir performance, probably the most popular is that of simulation where an artificial inflow sequence, modelled on the historic flow records, is used as input to a mathematical model of the reservoir. Another method which is not widely used is a probabilistic model on discrete Markov chains which was first proposed by Moran and extended to the case of serially correlated inflows by Lloyd. The purpose of this paper is to compare the two methods of analysis and to highlight advantages and disadvantages of each relative to the other when applied to a practical storage analysis. The reservoir used in the study is Vaal Dam. The author concludes with the remark that it had not been his intention to suggest that the Moran Model should replace simulation; but rather, that it is an independent, fast and accurate approach which

can with advantage be used as an adjunct to simulation to solve problems concerning the reliability of single reservoirs. (So Afr Water Info Ctr)  
W78-12393

**WATER RESOURCES - THE SOUTHERN AFRICAN PICTURE,** University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit. D. C. Midgley.  
In: Conference on resources of Southern Africa today and tomorrow, (Johannesburg) South Africa, p 251-258, September 22-26, 1975, 1 fig.

**Descriptors:** \*Water resources, Hydroelectric power, Industrial use, Water resources development, Interbasin transfers, International cooperation, \*South Africa, Zambia, Mozambique, Rhodesia, Lesotho, Swaziland, Botswana, Transkei, Tugela Vaal Government Water Project.

Discussed are the attractive mutual benefits throughout Southern Africa to be gained from collaboration between water-rich areas of the North and the mineral-rich areas of the South. Water and power links across international borders could be the means by which prosperity generated in the core region of South Africa, can spread throughout the subcontinent. Reticence by neighbouring states to avail themselves of the opportunity to benefit from South Africa's spiralling demands for electricity and water could precipitate a premature switch to maritime development, leaving the interior to plod with primary activities. In such circumstances the need for water links and a sub-continental electricity grid would be diminished with the result that economic advancement of South Africa's neighbour states could be retarded by several decades. (So Afr Water Info Ctr)  
W78-12423

**MYRIOPHYLLUM, A POWERFUL THREAT TO OUR WATER SUPPLIES,** Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.  
For primary bibliographic entry see Field 5G.  
W78-12427

**IS THE WATER HYACINTH A CURSE OR BLESSING.,** For primary bibliographic entry see Field 5G.  
W78-12433

**WEED HARVESTER - THE AQUA-TRIO WEED HARVESTING SYSTEM IN USE AT SANDVLEI** Municipal Engineer, Vol. 7, No. 3, p 21, 1976.

**Descriptors:** \*Aquatic weed control, \*Harvesting, Sandvlei, Nutrient removal, Equipment description, \*Potamogeton, \*South Africa.

A short article describing the Aqua-Trio weed harvesting system in use at Sandvlei in the Cape. The Aqua-Trio System consists of three parts: the Harvester, the Transport and the Shore conveyor, and it is estimated that it will clear 0,74ha of water infested with Potamogeton pectinatus weed, per day. (So Afr Water Info Ctr)  
W78-12436

**35 KM TUNNEL SYSTEM FOR CAPE WATER SCHEME,** Department of Water Affairs, Pretoria (South Africa). J. M. Matchett.  
South African Tunnelling, Vol 1, No 6, p 4-11, 1977.

**Descriptors:** \*Tunnel construction, Water resources, Inter basin transfers, Watersheds, Dams, Reservoirs, Water supply development, \*Cape water scheme, Theewaterskloof dam, As-

# WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

## Control Of Water On The Surface—Group 4A

segaibos Dam, Berg River Tunnel, Dasbos tunnel, Jonkershoek tunnel, Stellenboschberg tunnel, Western Cape, South Africa.

Presently under construction in the Western Cape is the Riviersonderend Berg river Government Water Scheme. The project, which comprises an interconnected system of dams and tunnels, will enable the winter surplus run-off of the upper reaches of the Sonderend, Berg, Dwars and Eerste Rivers to be collected, stored and subsequently used for agricultural, industrial and domestic purposes. The geological formation along the 35km tunnel route is very good granite to jointed sandstone, decomposed shales and granitic clay. (So Afr Water Info Ctr)  
W78-12444

**MADEN DAM RESERVOIR, KINGWILLIAMSTOWN,**  
G. C. Smith.  
Civil Engineer in South Africa, Johannesburg, Vol 19, No 8, p 192-194, 1977, 3 illus.

Descriptors: \*Reservoirs, Water supply, \*Impounding dams, Sand filters, History, \*Maden dam, South Africa.

A historical review of the water supply to Kingwilliamstown since 1861 when water supply was by furrow. In 1880 a pipeline replaced the furrow and in 1903 the Madsen Dam Reservoir was completed on the Buffalo River, known as the Pirie Water Scheme, which still supplies 70% of the town's water. (So Afr Water Info Ctr)  
W78-12472

**RIVER RUNOFF AND THE YIELD OF DAMS IN RHODESIA,**  
T. B. Mitchell.  
Rhodesia Science News (Salisbury) Vol 11, No 6, p 124-126, 1977, 3 fig, 1 tab.

Descriptors: \*River flow, Water storage, Dams, \*Average runoff, Groundwater recharge, Water yield, Evaporation loss, Southern Africa, \*Rhodesia.

In common with other countries, Rhodesia is concerned at the demands being made on its natural resources. Water is a natural resource and although it is renewable, there is a limit to the amount that is available for exploitation. The initial demand for water in Rhodesia's development was easily met from river flow in the high-rainfall areas, but with the accelerating water demand for urban development, industry, mining and irrigation, the inexpensive water in the form of natural stream flow has, in most areas, been taken up and further storage works because there will not be enough water available to fill them often enough. Thus, while it is still economical to build a costly large dam that will fill, say, once in every three years, it is uneconomical to build a costly large dam that will only fill once in every twenty-five years. The article further describes mean annual runoff from hydrological zones in Rhodesia, the zone description, the variation of annual runoff, the yield of dams and a summary of water statistics for Rhodesia. (So Afr Water Info Ctr)  
W78-12475

**RIVER MANAGEMENT,**  
For primary bibliographic entry see Field 2E.  
W78-12476

**INTEGRATED RIVER BASIN DEVELOPMENT AND AQUATIC ECOLOGY,**  
For primary bibliographic entry see Field 6G.  
W78-12500

**CABORA BASSA IN ITS FIRST YEAR: SOME ECOLOGICAL ASPECTS AND COMPARISONS,**  
For primary bibliographic entry see Field 6G.

W78-12501

**RELIABILITY OF FLOOD WARNING,**  
Illinois Univ. at Urbana-Champaign. Dept. of Civil and Ceramic Engineering.  
For primary bibliographic entry see Field 6F.  
W78-12528

**APPLICATION OF STOCHASTIC MODELS TO RESERVOIRS NEAR THE ALPS,**  
Technische Univ., Munich (West Germany). Inst. for Hydraulics and Hydrology.  
P. G. Franke, and Th. Leipold.  
In: Stochastic Processes in Water Resources Engineering, Proceedings, 2nd Intern. IAHR Symposium on Stochastic Hydraulics, Lund Institute of Technology, Sweden, August 1976. Lars Gottschalk, et al. (Eds.), Water Resources Publications, Fort Collins, Colorado, 1977, p 417-434 (Chapter 19). 5 fig, 6 tab, 11 ref.

Descriptors: \*Reservoir operation, \*Stochastic processes, \*Model studies, \*Simulation analysis, Optimization, \*Long-term planning, Inflow, Discharge(Water), Reservoir storage, Release rule, Hydrologic aspects, Monte Carlo method, Time series, Alps, Linear regression, Queuing theory, Equations, Systems analysis.

The basis for the long-term optimization of operating reservoirs is the use of models which describe this long-range process. As future natural flow in a river cannot be determined from that in the past by deterministic models, the inflow to a reservoir is assumed to be random. Therefore, the change of the discharge caused by a reservoir is a process which is deterministically regulated, but its course depends on the random inflow. To fulfill the requirements in theory and application, different types of stochastic models for reservoirs have been developed during the last twenty years. Herein, their applicability is investigated with respect to two existing reservoirs near the Alps. (Bell-Cornell)  
W78-12529

**A STOCHASTIC OPTIMIZATION MODEL OF THE LECH RIVER SYSTEM,**  
Technische Univ., Munich (West Germany). Inst. for Hydraulics and Hydrology.  
R. Jarboe.

In: Stochastic Processes in Water Resources Engineering, Proceedings, 2nd Intern. IAHR Symposium on Stochastic Hydraulics, Lund Institute of Technology, Sweden, August 1976. Lars Gottschalk, et al. (Eds.), Water Resources Publications, Fort Collins, Colorado, 1977, p 435-451 (Chapter 20). 8 fig, 2 tab, 5 ref.

Descriptors: \*Multiple-purpose reservoirs, \*Reservoir operation, \*Stochastic processes, \*Dynamic programming, \*Computer programs, \*Benefit maximization, \*Lech River System(Austria), \*Hydroelectric plants, Optimization, Mathematical models, Hydrologic aspects, Monthly, Flow, Algorithms, Reservoir releases, Constraints, Planning, Probability, Decision making, Recursive equations, Serial correlation, Sensitivity analysis, Operating policies.

A mathematical model is developed for optimizing the operation of a multiple-purpose reservoir and a series of hydroelectric power stations along the Lech River in Austria. The model includes the stochastic nature of hydrologic inputs, in particular its serial correlation among monthly flows. The objective function is the maximization of expected returns obtained from hydroelectric energy production, subject to a series of technical constraints. Computer programs to solve the optimization problem are based on dynamic programming algorithms. The optimal policies obtained show reservoir releases as a function of reservoir contents and inflow in the previous month, due to the serial correlation effect. Several sensitivity

analyses are performed in order to test the stability of the results. (Bell-Cornell)  
W78-12530

**MULTIPURPOSE RESERVOIR OPERATION USING STOCHASTIC TRADE-OFF ANALYSES,**  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
T. E. Croley, II, and K. N. R. Rao.  
In: Stochastic Processes in Water Resources Engineering, Proceedings, 2nd Intern. IAHR Symposium on Stochastic Hydraulics, Lund Institute of Technology, Sweden, August 1976. Lars Gottschalk, et al. (Eds.), Water Resources Publications, Fort Collins, Colorado, 1977, p 483-513 (Chapter 24). 13 fig, 32 tab, 23 ref.

Descriptors: \*Multiple-purpose reservoirs, \*Reservoir operation, \*Stochastic processes, \*Risk, \*Flood control, \*Recreation, \*Optimization, \*Trade-off analysis, Methodology, Measurement, Decision making, Constraints, Flood damage, Probability, Hydrology, Hydraulics, Equations, Mathematical models, Systems analysis, Multiobjective, Benefit maximization.

Non-commensurate, human factor multiobjectives are considered that are subjectively discerned and evaluated. Objectives are related in terms of real trade-off (noneconomic) benefits, and the need for a priori estimates of objective worth is eliminated. This 'trade-off' methodology systematically displays beneficial and adverse effects with regard to all operation objectives, so that different levels of achievement of each objective can readily be discerned and compared, indicating relevant trade-offs for optimum operations. The risk or confidence associated with each trade-off level synthetic input realizations. Decisions on reservoir operation can then be made which recognize both subjective trade-off choices and their reliabilities. A present conflict exists on the Coralville Reservoir near Iowa City between recreation opportunities and consequent higher pool levels; the latter maintain that the reservoir was originally designed for flood control and that any deviation from current operation plans will impair flood control benefits. The present study is evolving operation plans that provide more recreation opportunities with minimum disturbance of the flood control benefits. (Bell-Cornell)  
W78-12531

**A SIMPLE MATHEMATICAL MODEL OF QUANTITATIVE AND QUALITATIVE PROCESSES OCCURRING IN THE STREAM CHANNEL FOR WATER DISTRIBUTION CONTROL,**

Institute of Meteorology and Water Management, Krakow, Poland. Krakow Div.  
For primary bibliographic entry see Field 5G.  
W78-12538

**COMPUTER PREDICTION OF THE CHANGES IN RIVER QUALITY REGIMES FOLLOWING LARGE SCALE INTER BASIN TRANSFERS,**  
Department of the Environment, Reading (England). Central Water Planning Unit.  
For primary bibliographic entry see Field 5B.  
W78-12539

**AN ADAPTIVE ALGORITHM FOR ANALYZING SHORT-TERM STRUCTURAL AND PARAMETER CHANGES IN HYDROLOGIC PREDICTION MODELS,**  
Princeton Univ., NJ. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2A.  
W78-12551

**CHOICE OF DISTRIBUTION FUNCTIONS FOR HYDROLOGIC DESIGN,**  
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.  
For primary bibliographic entry see Field 8B.

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

W78-12552

**ALLOCATION OF WATER STORED FOR FLOOD CONTROL AND NAVIGATION PURPOSES (PROPOSED RULE).**  
Corps of Engineers, Washington, DC.  
For primary bibliographic entry see Field 6E.  
W78-12561

**THE WORLD REMOTE SENSING BIBLIOGRAPHIC INDEX.**  
Tensor Industries, Inc., Falls Church, VA.  
For primary bibliographic entry see Field 7B.  
W78-12618

**APPROXIMATION OF A NORMAL DISTRIBUTION BY A THREE-PARAMETER LOG NORMAL DISTRIBUTION.**  
Washington Univ., Seattle. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2E.  
W78-12631

**HOLOCENE STRATIGRAPHY IN FLOOD FREQUENCY ANALYSIS.**  
Denver Univ., CO. Dept. of Geography.  
For primary bibliographic entry see Field 2E.  
W78-12632

**CIRCULATION PATTERNS IN THE FOX CHAIN OF LAKES IN ILLINOIS.**  
Illinois State Water Survey, Urbana.  
For primary bibliographic entry see Field 2H.  
W78-12633

**FLOOD PLAIN INFORMATION: CORRALITOS CREEK, SANTA CRUZ COUNTY, CALIFORNIA.**  
Army Engineer District, San Francisco, CA.  
Prepared for Santa Cruz County, CA, June 1976, 18 p., 10 fig., 17 plates, 6 tab.

Descriptors: \*California, \*Streamflow forecasting, \*Flood forecasting, \*Flood profiles, \*Flood data, \*Floods, \*Flood flow, \*Historic floods, \*Flood frequency, \*Peak discharge, \*Stage-discharge relations, \*Flood plains, \*Standard Project Flood, \*Flood protection, \*Non-structural alternatives, \*Warning systems, \*Control structures, \*Levees, \*Corralitos Creek(CA), \*Santa Cruz County(CA), 100-year flood.

The study area involves the portion of Santa Cruz County that is subject to flood from Corralitos Creek. Land use in the flood plain is primarily agricultural, with some residential and commercial establishments. Flood data were obtained from topographic maps, historical sources, field studies, and stream gage records. The main flood season occurs from December through March and results from heavy rainfall. The worst flood recorded at the U.S. Geological Survey gage at Freedom occurred on December 22, 1955, cresting at 105.0 feet mean sea level (msl), and discharging 3,620 cubic feet per second (cfs). This flood caused the Creek slightly to exceed bankfull stage at several points. At the same location, the 100-year flood would crest at 107.5 feet msl and would discharge 6,600 cfs, while the Standard Project Flood (SPF) would crest at 108.4 feet msl and would discharge 8,500 cfs. Two bridges would be affected by the 100-year flood and three would be affected by the SPF. This study is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)  
W78-12650

**FLOOD PLAIN INFORMATION: LEVISA FORK AND TRIBUTARIES, BUCHANAN COUNTY, VIRGINIA, GRUNDY TO OAKWOOD.**  
Army Engineer District, Huntington, WV.

Prepared for Virginia Department of Conservation and Economic Development, January 1971, 39 p., 12 fig., 15 plates, 9 tab.

Descriptors: \*Virginia, \*Flood forecasting, \*Flood profiles, \*Flood data, \*Non-structural alternatives, \*Floods, \*Historic floods, \*Flood recurrence interval, \*Flood stages, \*Peak discharge, \*Flood plains, \*Standard Project Flood, \*Flood protection, \*Land use, \*Planning, \*Buchanan County(VA), \*Levisa Fork(VA), \*Big Sandy River(VA), \*Intermediate Regional Flood.

The study area involves a 14.7 mile segment of Levisa Fork of Big Sandy river and lower reaches of principal tributaries in Buchanan County, Virginia. Most public, commercial, and residential structures in the study area are located on the bottom lands subject to frequent flooding. Flood data were obtained from topographic maps, field studies, historical sources, and stream gage records. The main flood season occurs in late winter and early spring with all of the larger floods resulting from heavy general rainfall. On the small tributary streams, intense local thunderstorms may cause summer floods. The worst flood recorded at the U.S. Geological Survey gage near Grundy occurred on January 29, 1957, discharging 33,200 cubic feet per second (cfs) and cresting at 1010.4 feet mean sea level (msl). At the same location, the Intermediate Regional Flood (IRF) would discharge 40,500 cfs and would crest at 1012.7 feet msl, while the Standard Project Flood (SPF) would discharge 131,000 cfs and would crest at 1029.7 feet msl. Twenty eight of the 35 bridges in the study area would obstruct the IRF flow. This study is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)  
W78-12651

**SOCIAL IMPACT ASSESSMENT, 10.**  
For primary bibliographic entry see Field 6B.  
W78-12652

**OPTIONS FOR MONITORING LOCAL PERMITS IN THE NORTH CAROLINA COASTAL AREA.**  
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.  
For primary bibliographic entry see Field 6E.  
W78-12662

**PLAN OF ACTION: THE TRINITY RIVER PUBLIC INVOLVEMENT PROGRAM.**  
Texas A and M Univ., College Station. Dept. of Urban and Regional Planning.  
For primary bibliographic entry see Field 6B.  
W78-12664

**WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT: WHAT ARE THE NATION'S WATER SUPPLY PROBLEMS AND ISSUES.**  
General Accounting Office, Washington, DC.  
For primary bibliographic entry see Field 6D.  
W78-12665

**FLOOD EMERGENCY BUILDING INSPECTOR PROGRAM FOR THE CITY OF WILKES-BARRE.**  
Wilkes-Barre Dept. of Planning and Development, PA. Bureau of Flood Recovery.  
For primary bibliographic entry see Field 6F.  
W78-12667

**EFFECTS OF FILM ANTITRANSPIRANTS ON WOOD PLANTS (IN RUSSIAN).**  
Moscow Forestry Inst. (USSR).  
For primary bibliographic entry see Field 3B.  
W78-12668

**FLOOD-FREQUENCY ANALYSES WITH PRERECORD INFORMATION.**  
Geological Survey, Reston, VA. Water Resources Div.

G. D. Tasker, and W. O. Thomas, Jr.  
Journal of the Hydraulics Division, ASCE Proceedings, Vol. 104, No. HY2, Paper 13558, p. 249-259, February 1978. 5 tab, 5 ref, 2 append.

Descriptors: \*Floods, \*Flood frequency, \*Frequency analysis, \*Monte Carlo method, \*Historic floods, \*Simulation analysis, \*Peak discharge, \*Evaluation.

Monte Carlo experiments were performed on each of several procedures for treating historic flood information in flood-frequency analyses. The procedures differ in the sequence in which sample skew is weighted with a generalized skew and adjustment for information is made. The procedures also may differ in the weight given the generalized skew coefficient. The performance of each method was judged by how well the 100-year peak discharges determined by each method approximate the true value of the 100-year peak discharge of the Pearson Type III distribution underlying the generated data. Results indicate that when sample skew is adjusted for historic information before weighting with a generalized skew coefficient, it is better to use historic record length than systematic record length in computation of the weighting factor. Also, adjusting for historic information after weighting sample skew and generalized skew coefficients was the optimal method tested when overdesign losses are small compared to underdesign losses. (Woodard-USGS)  
W78-12729

**DROUGHT IN CALIFORNIA--WATER RESOURCES DATA FOR 1977.**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-12730

**DIGITAL MODEL OF GROUND-WATER FLOW IN THE PICEANCE BASIN, RIO BLANCO AND GARFIELD COUNTIES, COLORADO.**  
Geological Survey, Lakewood, CO. Water Resources Div.  
For primary bibliographic entry see Field 2F.  
W78-12731

**SEDIMENT TRANSPORT IN THE FEATHER RIVER, LAKE OROVILLE TO YUBA CITY, CALIFORNIA.**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 2J.  
W78-12736

**INTERIM REPORT ON STREAMFLOW, SEDIMENT DISCHARGE, AND WATER QUALITY IN THE CALABAZAS CREEK BASIN, SANTA CLARA COUNTY, CALIFORNIA.**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 4D.  
W78-12738

**WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1977--VOLUME I. ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY.**  
Geological Survey, Trenton, NJ. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-12742

**WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1977--VOLUME 2.**



# WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

## Groundwater Management—Group 4B

### DELAWARE RIVER BASIN AND TRIBUTARIES TO DELAWARE BAY.

Geological Survey, Trenton, NJ. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-12743

### WATER RESOURCES DATA FOR VIRGINIA, WATER YEAR 1977.

Geological Survey, Richmond, VA. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-12744

### WATER RESOURCES DATA FOR MISSISSIPPI, WATER YEAR 1977.

Geological Survey, Jackson, MS. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-12745

### DESCRIPTION OF THE ECOREGIONS OF THE UNITED STATES.

Forest Service (USDA), Ogden, UT.  
For primary bibliographic entry see Field 6G.  
W78-12749

### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, VOLUME 1: SUMMARY REPORT.

For primary bibliographic entry see Field 6B.  
W78-12760

### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, VOL. 2, APP. I: ECONOMICS; APP. II: CLIMATE AND METEOROLOGY; APP. III: HYDROLOGY, SURFACE GROUND WATER AND GEOLOGY; APP. IV: FLOOD CONTROL AND MAJOR DRAINAGE.

For primary bibliographic entry see Field 6B.  
W78-12761

### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, TEXAS, VOLUME 3, APPENDIX V: UPSTREAM WATERSHED PROTECTION, USE, MANAGEMENT, AND DEVELOPMENT.

For primary bibliographic entry see Field 6B.  
W78-12762

### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, TEXAS, VOL. 4, APPENDIX VI: IRRIGATION; APPENDIX VII: DRAINAGE AND FLOOD PREVENTION ON FLATLANDS.

For primary bibliographic entry see Field 6B.  
W78-12763

### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, APP. XI: WATER SUPPLY & WATER QUALITY CONTROL; APP. XII: OUTDOOR RECREATION; APP. XIII: FISH & WILDLIFE.

For primary bibliographic entry see Field 6B.  
W78-12765

### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, VOLUME 8, APPENDIX XV: PLAN FORMULATION.

For primary bibliographic entry see Field 6B.  
W78-12766

### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, AND TEXAS, VOLUME 7, APPENDIX XIV: STATE WATER LAWS, POLICIES AND PROGRAMS.

For primary bibliographic entry see Field 6B.  
W78-12767

### BIG BLACK RIVER, MISSISSIPPI—COMPREHENSIVE BASIN STUDY, VOLUME I: INTERAGENCY SUMMARY REPORT.

For primary bibliographic entry see Field 6B.  
W78-12768

### BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY, VOLUME III, ANNEX B: ENGINEERING STUDIES OF WATER DEVELOPMENT PROJECTS.

For primary bibliographic entry see Field 6B.  
W78-12770

### WATER LEVEL ALARM APPARATUS,

J. Eagle.  
U.S. Patent No. 4,080,985, 4 p. 1 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 968, No. 4, p 1333, March 28, 1978.

Descriptors: \*Patents, \*Water levels, \*Remote control, Floats, Valves, Overflow, Equipment.

A control mechanism terminates the flow of incoming water used to fill a container when a predetermined height is reached and also sounds an audible alarm. A float upon reaching an upper position, closes a set of stationary contacts, which in turn, completes a series of electrical circuit including an alarm bell and battery. Simultaneously with the closing of the contacts, an electrically operated solenoid valve, placed in series with a pipe connected to a water source closes, shutting down the incoming flow of water. Altering the length of the float or varying the positioning of the contacts, adjusts the maximum level of water within the container. (Sinha-OEIS)

W78-12773

### WATER MANAGEMENT DISTRICTS.

N.D. Cen. Code Ann. secs 61-16-01 thru -45 (1960) as amended (Suppl 1977); secs 61-16-46 thru -50 (Suppl. 1977).

Descriptors: \*North Dakota, \*Water districts, \*Water management(Applied), \*Legislation, Water conservation, Flood conservation, Flood control districts, Water control, Federal government, State government, Culverts, Dam construction, Regulation.

The North Dakota statutes chapter dealing with water conservation and flood control districts was amended in 1977. The procedure relating to petitions, bonds and hearings for the establishment of the districts was repealed. The area to be included within water management district was enlarged to encompass all land in North Dakota. The section exempting federal agencies from this chapter's provisions was also repealed. Also repealed were the sections dealing with the construction of bridges and culverts, and the procedure for dissolving a district or altering its boundaries. The procedure to be followed in ordering the creation of a water management district was set forth along with the appointment of a board of commissioners. In addition to its previous powers, the board was given the powers to do all things reasonably necessary and proper to preserve benefits to be derived from the conservation, control and regulation of water resources in the state. Joint exercise or power by two or more boards was provided. The financing method for the districts was provided for by special tax assessment. Many other operational procedures of the districts were also set forth in detail. (Quarles-Florida)

W78-12780

### INVENTORY OF WATER RESOURCES RESEARCH IN AUSTRALIA, 1976.

Australian Water Resources Council, Canberra Dept. of National Resources.  
For primary bibliographic entry see Field 2A.  
W78-12833

### MONO LAKE: SILENT, SAILLESS, SHRINKING SEA,

G. Rowell.  
Audobon, Vol. 80, No. 2, p 102-106, March, 1978.

Descriptors: \*California, \*Lakes, \*Diversion losses, Reservoirs, Streams, Water levels, Potential water supply, Diversion, Limnology, Alkalinity, Gulls.

California's Mono Lake has lost eight square miles of its previous 70 square mile surface since 1970, due to the diversion of two of its three tributary streams. Those two streams now empty into the Los Angeles Aqueduct, supplying 20 percent of that city's water needs. In this period of drought, there is not much interest in saving Mono Lake. Its alkaline waters are not suitable for sportfishing, boating or waterskiing. Its lunar-like landscape lacks traditional recreational value. But the lowering of the lake has created many legal problems. Shoreline property owners claim the newly exposed lands, as do state and federal governments by conflicting statutes. Basin residents and federal agencies complain about the blowing alkaline dust. Presently, the most vocal opponents of the lake's seemingly irreversible destruction are scientists—limnologists interested in its 700,000-year-old history and its unique chemistry, and biologists studying the state's largest single nesting colony of the California Gull. This article recounts the story of how the Los Angeles Department of Water and Power gained control of the Basin area and the present political situation. (Stump-Florida)

W78-12851

### REHABILITATION OF DEGRADED ARID LANDS,

United Nations, New York. Environment Programme; and Secretariat for International Ecology (Sweden).  
For primary bibliographic entry see Field 6E.  
W78-12916

### THE ARIZONA WATER COMMISSION'S CENTRA ARIZONA PROJECT WATER ALLOCATION MODEL SYSTEM,

Arizona Water Commission, Phoenix.  
For primary bibliographic entry see Field 6E.  
W78-12924

### STATISTICAL MODELS AND METHODS FOR RIVERS IN THE SOUTHWEST,

Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.  
For primary bibliographic entry see Field 2E.  
W78-12925

### RESPONSE TO DROUGHT,

Institute for Water Resources (Army), Fort Belvoir, Va.  
For primary bibliographic entry see Field 6B.  
W78-12943

## 4B. Groundwater Management

### NUMERICAL MODELLING OF LIQUID WASTE INJECTION INTO POROUS MEDIA SATURATED WITH DENSITY-STRATIFIED FLUID: A PROGRESS REPORT,

Hawaii Univ., Honolulu. Water Resources Research Center.  
For primary bibliographic entry see Field 5B.  
W78-12102

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4B—Groundwater Management

**CARBON CONTENTS AND SOURCES IN GROUND WATERS OF THE CENTRAL PLATTE REGION IN NEBRASKA**, Nebraska Univ., Lincoln. Conservation and Survey Div.  
For primary bibliographic entry see Field 5A.  
W78-12103

**MAPPING OF EARTH FISSURES IN LAS VEGAS VALLEY, NEVADA**, Nevada Univ. System, Reno. Water Resources Center.  
For primary bibliographic entry see Field 2F.  
W78-12107

**WISCONSIN GROUND WATER - AN ANNOTATED BIBLIOGRAPHY, 1973-1977**, Wisconsin Univ., Madison. Water Resources Center.  
For primary bibliographic entry see Field 2F.  
W78-12135

**EFFECT OF VEGETATION ON LANDFILL STABILIZATION**, Auburn Univ., AL. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W78-12136

**A STUDY OF THE KALAMOS SPRINGS IN GREECE WITH ENVIRONMENTAL ISOTOPES**, International Atomic Energy Agency, Vienna (Austria).  
For primary bibliographic entry see Field 2F.  
W78-12144

**A STUDY OF UNCONFINED NON-DARCY SEEPAGE TO A WELL**, Indian Inst. of Tech., Kharagpur (India). Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2F.  
W78-12151

**THE DEPENDENCE OF THE RESIDUAL GRAVITY ON HYDRAULIC CONSTANTS IN GLACIAL DEPOSITS**, Rhode Island Univ., Kingston. Dept. of Geology.  
For primary bibliographic entry see Field 2F.  
W78-12156

**FRESNO, CALIF., SUBSURFACE DRAIN COLLECTOR-DEEP WELL RECHARGE SYSTEM**, Agricultural Research Service, Fresno, CA. Water Management Research.  
W. C. Bianchi, J. J. Nightingale, and R. L. McCormick.  
Journal of the American Water Works Association, Vol. 70, No. 8, p 427-435, August 1978. 12 fig, 9 tab, 32 ref.

Descriptors: \*Groundwater recharge, \*California, \*Artificial recharge, \*Recharge wells, \*On-site investigations, Groundwater, Injection wells, On-site tests, Water quality, Flooding, Drainage, Subsurface drainage, Tile drainage, Water wells, Infiltration, Perched water, Aquifers, Costs, Turbidity, Specific capacity, Discharge(Water).

A system was described that greatly expands the geological profiles that can be used as recharge areas. Water was filtered through sand soil, collected in an agricultural drain placed in the shallow-perched water table, and gravity-fed into a specially designed recharge well. Recharge volume was increased by 75%. The collected water was low in dissolved gases and sufficiently low in suspended solids to allow gravity well recharge. The recharge well was designed to allow controlled mining of clogged aquifer sands. A system employing this technology could greatly expand the soil profiles that can be used as recharge areas

by providing a way to bypass low-permeability subsurface horizons limiting vertical water movement into the groundwater table. The successful performance of the Fresno drain collector-recharge well system, as indicated by 600 acre-ft of recharge water, results from preconditioning surface canal water by soil filtration before injection. (Humphreys-ISWS)  
W78-12158

**COMPREHENSIVE ANALYSIS OF WATER-TABLE AQUIFER TEST DATA**, Upper Mississippi River Basin Commission, Twin Cities, MN. Minnesota.  
W. C. Walton.  
Ground Water, Vol. 16, No. 5, p 311-317, September-October 1978. 6 fig, 4 tab, 11 ref.

Descriptors: \*Analytical techniques, \*Water table aquifers, \*Aquifer testing, \*Graphical analysis, Curves, Graphical methods, Groundwater, Wells, Anisotropy, Permeability, Saturated flow, Penetration, Storage, Storage coefficient, \*Type curves, \*Partial penetration, \*Casing storage, Vertical permeability.

Flow to wells in water table aquifers is related to anisotropy, vertical components of flow, well storage capacity, degree of well penetration, and changes in aquifer saturated thickness. The manner and extent to which these factors affect water levels may be evaluated with aquifer test data. Families of type curves describe the typical S-shaped curves of log drawdown versus log time observed around wells in water table aquifers. Comprehensive analysis of water table aquifer test data is possible with the array of equations derived largely in the late 1950's to 1970's. Erroneous data analysis will result unless complicating factors are fully recognized and taken into account. This paper reviewed existing methods which were accepted and recommended for groundwater investigator use. (Visocky-ISWS)  
W78-12165

**NUCLEAR TECHNIQUES APPLICABLE TO STUDIES OF POLLUTANTS IN GROUND WATER**, Battelle Pacific Northwest Labs., Richland, WA.  
For primary bibliographic entry see Field 5A.  
W78-12168

**GEOCHEMISTRY AND HYDROTHERMAL ALTERATION AT SELECTED UTAH HOT SPRINGS. VOLUME 3**, Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.  
For primary bibliographic entry see Field 2K.  
W78-12171

**DETERMINATION OF CADMIUM IN WATERS OF THE STATE OF PIAUI, BRAZIL (DETERMINACAO DE CADMIO EM AGUAS DO ESTADO DO PIAUI, BRASIL)**, Ceara Univ., Fortaleza (Brazil). Centro de Ciencias.  
For primary bibliographic entry see Field 2K.  
W78-12213

**DETERMINATION OF IRON, MANGANESE, COPPER AND ZINC IN WATERS OF THE STATE OF PIAUI, BRAZIL (DETERMINACAO DE FERRO, MANGANESE, COBRE E ZINCO EM AGUAS DO ESTADO DO PIAUI, BRASIL)**, Ceara Univ., Fortaleza (Brazil). Centro de Ciencias.  
For primary bibliographic entry see Field 2K.  
W78-12214

**DETERMINATION OF BORON IN WATERS OF THE STATE OF PIAUI, BRAZIL**

(DETERMINACAO DE BORO EM AGUAS DO ESTADO DO PIAUI, BRAZIL), Ceara Univ., Fortaleza (Brazil).  
For primary bibliographic entry see Field 2K.  
W78-12215

**ON THE STATE OF SATURATION OF GROUNDWATER WITH RESPECT TO DISSOLVED CARBONATES, EDWARDS ARTESIAN AQUIFER, SOUTH-CENTRAL TEXAS**, San Diego State Univ., CA. Dept. of Geological Sciences.  
For primary bibliographic entry see Field 2K.  
W78-12216

**THE APPLICATION OF A SURFACE CLIMATE SIMULATOR TO MONTEZUMA WELL, ARIZONA**, Arizona State Univ., Tempe.  
For primary bibliographic entry see Field 2B.  
W78-12217

**THE LEGALIZATION OF GROUNDWATER STORAGE**, Southern California Metropolitan Water District, Los Angeles.  
For primary bibliographic entry see Field 6E.  
W78-12218

**EFFECT OF BALCONES FAULTS ON GROUNDWATER MOVEMENT, SOUTH CENTRAL TEXAS**, San Diego State Univ., CA. Dept. of Geological Sciences.  
For primary bibliographic entry see Field 2F.  
W78-12219

**INTERRELATIONSHIP OF GROUND AND SURFACE WATER QUALITY IN THE EL PASO-JUAREZ AND MESILLA VALLEYS**, New Mexico State Univ., University Park. Coll. of Engineering.  
For primary bibliographic entry see Field 5B.  
W78-12225

**THE UPPER RIO GRANDE**, New Mexico State Univ., University Park. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6E.  
W78-12229

**INSTITUTIONAL ALTERNATIVES FOR MEXICO-U.S. GROUNDWATER MANAGEMENT**, City Univ. of New York.  
For primary bibliographic entry see Field 6E.  
W78-12230

**GROUNDWATER OCCURRENCE AND UTILIZATION IN THE ARIZONA-SONORA BORDER REGION**, Arizona Univ., Tucson. Dept. of Hydrology; and Arizona Univ., Tucson. Dept. of Geosciences.  
M. D. Bradley, and K. J. DeCook.  
Natural Resources Journal, Vol 18, p 29-47, January, 1978. 2 fig, 26 ref, Spanish summary.

Descriptors: \*Water management(Applied), Groundwater resources, International waters, Mexico, Colorado River, Drawdown, Pumping, Long-term planning.

Population growth and expansion of agricultural production along the border have increased pressure on both surface and ground waters. The lack of international agreements governing groundwater use has resulted in a modern parallel to the conflict between Mexico and the United States over the allocation of Colorado River water. As Mexican pumping causes a drawdown of groundwater from the U.S. side of the border, proposals

# WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

## Groundwater Management—Group 4B

have been made to institute a protective and regulatory pumping scheme near Yuma, Arizona. Rather than short-term solutions of this nature, accelerated water use requires a long-range strategy of water management and resource planning based on the notion of the international water resource system, which encompasses all surface and groundwaters shared by more than one nation. (Russell-Arizona)  
W78-12233

**PROTRACTED RECHARGE OF TREATED SEWAGE INTO SAND: PART II - TRACING THE FLOW OF CONTAMINATED GROUND WATER WITH A RESISTIVITY SURVEY,** Rensselaer Polytechnic Inst., Troy, NY.  
For primary bibliographic entry see Field 5D.  
W78-12305

**PROTRACTED RECHARGE OF TREATED SEWAGE INTO SAND: PART I - QUALITY CHANGES IN VERTICAL TRANSPORT THROUGH THE SAND,** Rensselaer Polytechnic Inst., Troy, NY.  
For primary bibliographic entry see Field 5D.  
W78-12306

**USE OF HYDROCHEMICAL TECHNIQUES IN GROUNDWATER EXPLORATION IN THE VENTERSTAD AREA, CAPE PROVINCE (IN AFRIKAANS),**  
For primary bibliographic entry see Field 2F.  
W78-12465

**RESTORATION OF THE DOLOMITE WATER BALANCE AT WESTERN AREAS GOLD MINING COMPANY LTD,** A. Vogelzang.  
Journal of the South African Institute of Mining and Metallurgy (Johannesburg), Vol 78, No 3, p 73-78, 1977. 4 fig.

Descriptors: Restoration, \*Water level, \*Groundwater recharge, \*Mines, Dolomite, Pumping geological structure, Sinkholes, Boreholes, Pipelines, Dams, Overflow, South Africa.

A description is presented of how the level of the water-table was reduced as a result of increased pumping of water from the mine. Because such a condition in an area where there is compactable material above solid dolomite results in surface movement, steps were taken to restore the water-table to its former level. These included the return of water underground via a sinkhole and boreholes, and the piping of water from another mine. (So Afr Water Info Ctr)  
W78-12488

**AGENCY CREATED TO FIGHT COASTAL SUBSIDENCE MENACE,** Harris-Galveston Coastal Subsidence District, Houston, TX.  
For primary bibliographic entry see Field 6E.  
W78-12566

**RULES AND REGULATIONS GOVERNING WATER WELLS IN FLORIDA.** Florida State Dept. of Environmental Regulation, Tallahassee. Div. of Environmental Permitting.  
For primary bibliographic entry see Field 6E.  
W78-12569

**GROUND WATER AND WELLS.**  
For primary bibliographic entry see Field 6E.  
W78-12590

**BIBLIOGRAPHY AND INDEX OF WISCONSIN GROUNDWATER, 1851-1972: ADDENDUM 1834-1972.** Wisconsin Univ.-Madison. Water Resources Center.  
For primary bibliographic entry see Field 10C.  
W78-12600

**GROUND WATER IN THE CALIFORNIA WATER QUANDRY,** Environmental Defense Fund, Washington, DC. W. R. S. Wiley.  
In: Proceedings of the Eleventh Biennial Conference on Groundwater, September 15-16, 1977, Fresno, California, California Water Resources Center, University of California, Davis, Report No. 41, November 1977, p 18-26.

Descriptors: \*California, \*Economic impact, \*Groundwater resources, \*Overdraft, Diversion, Energy loss, Groundwater, Groundwater availability, Groundwater recharge, Land subsidence, Water resources, Aquifer management.

California's groundwater resources present an important option in any attempt to alleviate the states' growing water crises. The most commonly mentioned concern with California's groundwater resource is overdraft. Overdraft is generally defined as the amount of water extracted which exceeds recharge from both natural and imported sources. One impact of overdraft is in the lowering of groundwater levels and concomitant increased pumping lifts required. Land subsidence and reduced aquifer storage capacity sometimes result from overdraft. The present status of actual controls on groundwater use in California is limited and ineffectual. This arises not only from the lack of precise management objectives for California's water resources in general, but also from a virtually complete absence of economic incentives or water quality standards as necessary parts of a management plan. The objective of groundwater management in California ought to be as it presently exists in state law--beneficial and reasonable use plus development and protection of aquifer resources. Standards, economic incentives, and water rights are the basis upon which groundwater use rules need to be formulated in California. (See also W78-06039) (Jordan-Florida)  
W78-12615

**THE ROLE OF 208 IN PLANNING GROUND-WATER USE,** Southern California Association of Governments, Los Angeles.  
For primary bibliographic entry see Field 5G.  
W78-12616

**THE INFLUENCE OF THE SAN FERNANDO CASE ON THE WORK OF THE GOVERNOR'S WATER RIGHTS COMMISSION,** A. J. Schneider.  
In: Proceedings of the Eleventh Biennial Conference on Groundwater, September 15-16, 1977, Fresno, California, California Water Resources Center, University of California, Davis, Report No. 41, November 1977, p 34-46.

Descriptors: \*Beneficial use, \*California, \*Groundwater, \*Judicial decisions, Economics, Groundwater resources, Management, Prior appropriation, Pueblo water rights, Pumping, Competing uses, Water rights.

The California Supreme Court decision in City of Los Angeles v. City of San Fernando has had a tremendous impact on the legal position of groundwater pumpers and on groundwater management programs. The case has become the focal point of groundwater law in California. The Courts' guidance to the trial court on remand was direct and specific: the basis of any new judgement must be 'the constitutional duty to protect the parties' rights in a manner that would minimize waste and

maximize beneficial use of the water in controversy. Three points are very important: (1) San Fernando's costs indicate that reliance on the courts may be too expensive to be an option; (2) groundwater pumpers now face a great deal of uncertainty as to how to protect their interests; and (3) groundwater management entities may have to address problems they cannot work out on a local basis. In all, it has taken more than 40 years to adjudicate the rights of relatively few parties to an average groundwater supply of 100,000 acre-feet per year. (See also W78-06039) (Jordan-Florida)  
W78-12617

**A MULTILEVEL DEVICE FOR GROUND-WATER SAMPLING AND PIEZOMETRIC MONITORING,** Department of the Environment, Ottawa (Ontario). Hydrology Research Div.  
For primary bibliographic entry see Field 7B.  
W78-12636

**SPATIAL AND TEMPORAL HYDROCHEMICAL VARIATIONS IN A SEMICONFINED BURIED CHANNEL AQUIFER: ESTERHAZY, SASKATCHEWAN, CANADA,** Waterloo Univ. (Ontario). Dept. of Earth Sciences.  
For primary bibliographic entry see Field 2K.  
W78-12637

**USE OF LABORATORY DATA TO PREDICT SULFATE SORPTION DURING ARTIFICIAL GROUND-WATER RECHARGE,** Geological Survey, Reston, VA. Water Resources Div.  
W. W. Wood.  
Ground Water, Vol. 16, No. 1, p 22-31, January-February 1978. 15 fig, 1 tab, 21 ref.

Descriptors: \*Groundwater movement, \*Artificial recharge, \*Forecasting, \*Sulfates, \*Sorption, Model studies, Water quality, Methodology, Unsaturated flow, Porous media, Aquifers, Adsorption, Groundwater recharge, Texas, \*Lubbock area.

Sulfate sorption data determined from laboratory investigations were used to predict movement of sulfate during a field experiment of artificial ground-water recharge in a basin near Lubbock, Texas. Laboratory studies confirmed that sulfate sorption is controlled in the system by surface area, content of iron oxides and hydroxides, and pH. Predicted sulfate distribution in the unsaturated zone was made by assuming constant one-dimensional flow. Where these assumptions were not, predictions were generally good at shallow depths and for short times. At greater depths and longer times, these assumptions combined with other factors, such as changes in effective porosity, variable mineralogy, changing hydrodynamic dispersion coefficients, and variable infiltration rates contributed to the failure of the predicted values to match the observed data. It appears that sulfate distribution in the unsaturated zone during artificial recharge can be predicted by using laboratory data if the flow conditions in the field can be described adequately. (Woodard-USGS)  
W78-12724

**ARTIFICIAL GROUND-WATER RECHARGE AS A WATER-MANAGEMENT TECHNIQUE ON THE SOUTHERN HIGH PLAINS OF TEXAS AND NEW MEXICO,** Geological Survey, Austin, TX. Water Resources Div.  
R. F. Brown, D. C. Signor, and W. W. Wood.  
Texas Department of Water Resources, Austin, Report 220, August 1978. 32 p, 13 fig, 1 tab.

Descriptors: \*Artificial recharge, \*Aquifer management, \*Injection wells, \*Water spreading, \*Playas, Irrigation, Water treatment, Methodology



## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4B—Groundwater Management

gy, Water management(Applied), Texas, New Mexico, \*Southern High Plains, \*Ogallala Formation.

Artificial ground-water recharge of the Ogallala Formation of late Tertiary age is a water-management technique that may be of significant value on the Southern High Plains of Texas and New Mexico. Under specific conditions artificial recharge by use of either water-spreading basins or injection wells is a proved method of storing water that is available from the playa lakes on the Southern High Plains of Texas and New Mexico. Spreading basins are the most economical method of recharge in most areas of the Southern High Plains; however, in many areas where the surficial materials have low vertical permeability, and where the spreading-basin method cannot be used successfully, water can be recharged through injection wells. Artificial recharge of playa-lake water is more likely to be successful if the water is collected from near the surface of the playa lakes, treated and clarified in a settling basin, and recharged through a system that minimizes the clogging effect of suspended sediment. Reduction of the infiltration rate is minimized if the recharged water contains little or no suspended sediment. Case histories of recent recharge experiments on the Southern High Plains, the results of laboratory studies of sediment flocculation of playa-lake water, and a cost analysis of recharge systems are presented. (Woodard-USGS) W78-12725

**GROUND-WATER RESOURCES OF ADAMS AND BOWMAN COUNTIES, NORTH DAKOTA,** Geological Survey, Bismark, ND. Water Resources Div.  
For primary bibliographic entry see Field 2F. W78-12727

**HYDROLOGIC ANALYSIS OF THE U.S. BUREAU OF MINES' UNDERGROUND OIL-SHALE RESEARCH-FACILITY SITE, PICEANCE CREEK BASIN, RIO BLANCO COUNTY, COLORADO,** Geological Survey, Lakewood, CO. Water Resources Div.  
For primary bibliographic entry see Field 8B. W78-12732

**METHOD OF ESTIMATING NATURAL RECHARGE TO THE EDWARDS AQUIFER IN THE SAN ANTONIO AREA, TEXAS,** Geological Survey, Tuscaloosa, AL. Water Resources Div.  
For primary bibliographic entry see Field 2F. W78-12733

**AN EVALUATION OF PROBLEMS ARISING FROM ACID MINE DRAINAGE IN THE VICINITY OF SHASTA LAKE, SHASTA COUNTY, CALIFORNIA,** Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 5G. W78-12735

**PLAN OF STUDY FOR THE HIGH PLAINS REGIONAL AQUIFER-SYSTEM ANALYSIS IN PARTS OF COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA, SOUTH DAKOTA, TEXAS, AND WYOMING,** Geological Survey, Lakewood, CO. Water Resources Div.  
J. B. Weeks.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 668, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-70, June 1978. 28 p, 2 fig.

**Descriptors:** \*Aquifer management, \*Groundwater resources, \*Project planning, \*Scheduling, \*Computer models, Hydrogeology, Aquifer characteristics, Regional analysis, Groundwater availability, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, Wyoming, \*High Plains, \*Ogallala Formation, \*Great Plains.

The Ogallala Formation and associated Tertiary and Quaternary deposits from the principal aquifers supporting irrigation in the High Plains of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. The volume of water in storage within the aquifers is declining in most of the High Plains because water is being withdrawn in excess of the rate of replenishment. The U.S. Geological Survey has initiated a 5-year study of the High Plains aquifer system to develop the geohydrologic data base and computer models of the ground-water flow system needed to evaluate the response of the aquifer system to ground-water management alternatives. This report describes the objectives, plan, and organization of the study and outlines the work to be accomplished in each State in the study area. (Woodard-USGS) W78-12739

**WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1977--VOLUME 1. ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY.** Geological Survey, Trenton, NJ. Water Resources Div.  
For primary bibliographic entry see Field 7C. W78-12742

**WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1977--VOLUME 2. DELAWARE RIVER BASIN AND TRIBUTARIES TO DELAWARE BAY.** Geological Survey, Trenton, NJ. Water Resources Div.  
For primary bibliographic entry see Field 7C. W78-12743

**WATER RESOURCES DATA FOR VIRGINIA, WATER YEAR 1977.** Geological Survey, Richmond, VA. Water Resources Div.  
For primary bibliographic entry see Field 7C. W78-12744

**WATER RESOURCES DATA FOR MISSISSIPPI, WATER YEAR 1977.** Geological Survey, Jackson, MS. Water Resources Div.  
For primary bibliographic entry see Field 7C. W78-12745

**PERMITTING OF ARTIFICIAL RECHARGE SYSTEMS.** Florida Dept. of Natural Resources. Suwannee River Water Management District, White Springs, FL.  
For primary bibliographic entry see Field 6E. W78-12839

**LAND SUBSIDENCE IN THE SANTA CLARA VALLEY.** Geological Survey, Sacramento, CA.  
For primary bibliographic entry see Field 2F. W78-12941

**ASSESSMENT OF THE TOXICITY OF LAND-FILL LEACHATES BY THE RESIDUAL OXYGEN BIOASSAY.** EVS Consultants Ltd., New Westminster (British Columbia).  
For primary bibliographic entry see Field 5A. W78-12960

### 4C. Effects On Water Of Man's Non-Water Activities

**EFFECTS OF SKI AREA DEVELOPMENT AND USE ON STREAM WATER QUALITY OF THE SANTA FE BASIN, NEW MEXICO,** New Mexico Univ., Albuquerque. Dept. of Biology.  
For primary bibliographic entry see Field 5B. W78-12277

**STUDIES ON FUNCTION OF WATER AND SOIL CONSERVATION BASED ON FOREST LAND: II. INFLUENCE OF DISTURBANCE IN GROUND FLOOR UPON WATER RUNOFF, INFILTRATION AND SOIL EROSION, AND THE CONSERVATION MANAGEMENT OF FOREST LAND (IN JAPANESE),** Government Forest Experiment Station, Tokyo (Japan).  
H. Mural, and Y. Iwasaki.  
Bull Gov For Exp Stn (Tokyo) 286, p 1-52, 1976.

**Descriptors:** \*Water conservation, \*Soil conservation, \*Clear-cutting, Burning, Runoff, Infiltration, \*Soil erosion, \*Forest management, Fire, Forests, Infiltrometer, Japan, Slopes, Tohoku.

The influence of disturbances to the ground floor such as cutting and logging of the forest, forest fire or forest grazing upon the water and conservation functions of the forest land was evaluated. Analysis of factors such as surface runoff, infiltration or soil erosion on several examples of disturbance or on the specially provided model working areas, through comparing the disturbed with the undisturbed land, was presented. Measurements were made using the slope infiltrometer and soil erosion gauge. The investigation area centered in the mountainous drainage basin in the Tohoku district, Japan. The length of the study was 10 yr, 1965-1975.--Copyright 1978, Biological Abstracts, Inc. W78-12463

**REMOTE SENSING TO IDENTIFY, ASSESS, AND PREDICT ECOLOGICAL IMPACT ON LAKE CHAMPLAIN WETLANDS,** State Univ. of New York Coll. at Plattsburgh.  
For primary bibliographic entry see Field 6G. W78-12601

**A HISTORICAL SURVEY OF WATER UTILIZATION IN THE COOK INLET-SUSITNA BASIN, ALASKA,** Alaska Univ., College. Inst. of Water Resources.  
For primary bibliographic entry see Field 6B. W78-12605

**ORIGIN OF BLANKET MIRES,** King's Coll., London (England). Dept. of Plant Sciences.  
P. D. Moore.  
Nature, Vol 256, No 5515, p 267-269, July 24, 1975. 2 tab, 59 ref.

**Descriptors:** \*Clear-cutting, \*Bogs, \*Britain, \*Blanket mores, \*Prehistoric man, Wetlands, Hydrology, Forests, Transpiration, Lumbering, Human population.

Prehistoric man was theoretically capable of influencing catchment hydrology in ways which would create effects of magnitude similar to those produced by major climatic changes. By clearing forests (usually associated with herbivore production) Mesolithic and Neolithic populations could increase local groundwater supply by reducing transpiration demands and interception by the crown. Such changes in hydrology could initiate peat formation. Pollen analyses indicate that peat

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Watershed Protection—Group 4D

initiation often occurred at about the time of elm decline; elm decline is usually accompanied by indications of human activity and forest clearance. (Stihler-Mass)  
W78-12685

**PLAN AND CONCEPTS FOR MULTI-USE MANAGEMENT OF THE ATCHAFALAYA BASIN.**  
Coastal Environments, Inc., Baton Rouge, LA.  
For primary bibliographic entry see Field 6G.  
W78-12686

**AN ATTEMPT TO DETECT THE EFFECTS OF A STEELWORKS ON PRECIPITATION AMOUNTS IN CENTRAL HUNGARY.**  
Illinois Univ., Urbana-Champaign. Dept. of Ecology, Ethology, and Evolution; and Illinois Univ., Urbana-Champaign. Inst. for Environmental Studies.  
For primary bibliographic entry see Field 5B.  
W78-12860

**REHABILITATION OF DEGRADED ARID LANDS.**  
United Nations, New York. Environment Programme; and Secretariat for International Ecology (Sweden).  
For primary bibliographic entry see Field 6E.  
W78-12916

**DESERTIFICATION PROCESSES AND THE SEARCH FOR SOLUTIONS.**  
Ben Gurion Univ. of the Negev, Beersheba (Israel). Research and Development Authority.  
J. Schechter.

Interdisciplinary Science Reviews, Vol. 2, No. 1, p 36-54, March 1977. 4 fig, 2 tab, 136 ref.

Descriptors: \*Deserts, \*Land use, Management, \*Social aspects, Non-structural alternatives, \*Desertification, Overgrazing, Air pollution, Conservation, Technology.

The dominant cause of desertification is the influence of man through (1) population pressures leading to overstocking and overgrazing, (2) destructive irrigation and cultivation practices, (3) atmospheric pollution contributing to climatic change, and (4) other social, political and cultural factors. The process can be contained and even reversed by sound management and conservation of land and water resources. The major focus of research leading to a solution to desertification should be on man himself, including social organization, nomadism and sedentarization, technology transfers, population control, education, and other problems. (Russell-Arizona)  
W78-12921

**CAN DESERTIZATION BE STOPPED. SUMMARY AND RECOMMENDATIONS.**  
United Nations, New York. Environment Programme; and Secretariat for International Ecology (Sweden).  
For primary bibliographic entry see Field 6E.  
W78-12937

#### 4D. Watershed Protection

**MAXIMUM NONEROSIVE FURROW IRRIGATION STREAM SIZE.**  
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.  
S. N. Hamad, and G. E. Stringham.  
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR3, Proceedings Paper 14021, p 275-281, Sept. 1978. 3 fig, 1 tab, 13 ref, 2 append.

Descriptors: \*Furrow irrigation, \*Erosion, \*Irrigation ditches, Size, Slopes, Slope stability, Channels, Channel erosion, Channel flow, Irrigation, Surface irrigation, Soils, Water pollution, Sediments.

A technique was presented to predict maximum nonerosive irrigation stream size for furrows as a function of soil type and bed slope. Data for different soils and field conditions were analyzed to estimate the coefficients of a prediction equation. A table giving the estimated coefficients for each soil type was given. (Sims-ISWS)  
W78-12143

**A SEDIMENT GRAPH MODEL BASED ON AN INSTANTANEOUS UNIT SEDIMENT GRAPH.**  
Agricultural Research Service, Temple, TX. Grassland Forage Research Center.  
J. R. Williams.  
Water Resources Research, Vol. 14, No. 4, p 659-664, August 1978. 2 fig, 3 tab, 10 ref.

Descriptors: \*Sedimentation rates, \*Erosion, \*Texas, \*Storm runoff, \*Model studies, Mathematical models, Sediments, Rainfall, Watersheds (Basins), Land use, Agriculture, Storms, Precipitation (Atmospheric), Sediment yield, Sedimentology.

A model was developed for predicting sediment graphs from agricultural watersheds. Storm sediment graphs were predicted by convolving source runoff with an instantaneous unit sediment graph (IUSG). The IUSG is the distribution of sediment from an instantaneous burst of rainfall producing one unit of runoff. The IUSG is the product of an instantaneous unit hydrograph and the sediment concentration distribution. Initial sediment concentration of the IUSG was assumed to vary linearly with source runoff volume. A sediment-routing function, based on travel time and sediment particle size, was used to predict the sediment concentration distribution. Tests with 50 storms from 5 watersheds showed that the model is applicable to agricultural watersheds in the Texas blacklands. It should be useful in designing reservoirs or in water quality-modeling problems. (Sims-ISWS)  
W78-12145

**WATER RESOURCES AND THE LAND-WATER INTERFACE.**  
Illinois Univ., Urbana-Champaign. Dept. of Ecology, Ethology, and Evolution.  
For primary bibliographic entry see Field 5B.  
W78-12164

**STOCHASTIC MODELING OF WATERSHED SYSTEMS.**  
Illinois Univ. at Urbana-Champaign.  
For primary bibliographic entry see Field 2A.  
W78-12264

**MACROINVERTEBRATE AND WATER QUALITY-QUANTITY SURVEY OF OTTER CREEK, PIUTE COUNTY, UTAH.**  
Brigham Young Univ., Provo, UT. Center for Health and Environmental Studies.  
R. N. Winget, and R. W. Baumann.  
Funded by Bureau of Land Management, Final Report, November 1977. 11 p, 4 tab, 1 fig. UT-910-PH7-821.

Descriptors: \*Watershed management, \*Macrobenthos, \*Stream improvement, \*Water quality, Land management, Grazing, \*Utah, \*Otter Creek (Utah), Surveys, Environmental effects, Environmental Impact Evaluation, National Resource Lands, Critical Aquatic Habitat, Grazing Impacts, BLM administered streams.

Otter Creek, Piute County, Utah was surveyed for: (1) general water quality; (2) macroinver-

tebrate community condition; and (3) general hydrology relating to a possible underground aquifer. The US Bureau of Land Management had installed four rock-basket gabions in the stream in a fisheries habitat improvement attempt. Water users had charged that the gabions were causing a water loss by ground water recharge through the stream banks behind each gabion. Results of the survey indicated an extensive underground aquifer with continual loss of surface waters to the aquifer and stream recharge via springs. The gabions did not affect downstream flows. Water quality and macroinvertebrate community indicated a high potential for a successful fisheries in Otter Creek. (BLM)  
W78-12303

**CONTROL OF WATER CATCHMENTS BY THE DEPARTMENT OF FORESTRY.**  
D. P. Ackerman.  
South African Forestry Journal (Pretoria), Vol. 98, p 24-27, 1976.

Descriptors: \*Catchment areas, Wildlife conservation, Forestry, \*Forest watersheds, Water resources conservation, Recreation facilities, Legal aspects, \*Watershed management, \*South Africa.

A short historical review explains how the Department of Forestry controls water catchment areas in South Africa. In 1970 the government decided that the department of forestry should take over the responsibility for the conservation of all mountain catchment areas, whether in public or in private ownership and to this end, the Mountain Catchment Areas Act - 1970, was passed by parliament. The provisions of this act are briefly summarized. The multiple use of forest land is discussed, which includes plantations, indigenous forests, conservation of water and wilderness areas. (So Afr Water Info Ctr)  
W78-12410

**STUDIES ON FUNCTION OF WATER AND SOIL CONSERVATION BASED ON FOREST LAND: II. INFLUENCE OF DISTURBANCE IN GROUND FLOOR UPON WATER RUNOFF, INFILTRATION AND SOIL EROSION, AND THE CONSERVATION MANAGEMENT OF FOREST LAND (IN JAPANESE).**  
Government Forest Experiment Station, Tokyo (Japan).  
For primary bibliographic entry see Field 4C.  
W78-12463

**EVALUATION OF DETENTION BASINS FOR CONTROLLING URBAN RUNOFF AND SEDIMENTATION.**  
Kentucky Water Resources Research Inst., Lexington.  
For primary bibliographic entry see Field 2A.  
W78-12608

**TRANSITION ZONES OF FORESTED INLAND WETLANDS IN NORTHEASTERN CONNECTICUT.**  
Connecticut Univ., Storrs. Inst. of Water Resources.  
For primary bibliographic entry see Field 6G.  
W78-12609

**INTERIM REPORT ON STREAMFLOW, SEDIMENT DISCHARGE, AND WATER QUALITY IN THE CALABAZAS CREEK BASIN, SANTA CLARA COUNTY, CALIFORNIA.**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
J. M. Knott, G. L. Pederson, and R. F. Middelburg.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 291, Price codes: A03 in paper copy, A01 in microfiche.

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4D—Watershed Protection

Water-Resources Investigations 78-2, April 1978. 41 p, 12 fig, 8 tab, 13 ref.

Descriptors: \*Sediment transport, \*Baseline studies, \*Rainfall-runoff relationships, \*Water quality, \*California, Urbanization, Streamflow, Flow rates, Sediment discharge, Heavy metals, Pesticides, Santa Clara County(Calif), \*Calabazas Creek basin(Calif).

Streamflow, sediment-discharge, and water-quality data are being collected in the Calabazas Creek basin, Santa Clara County, Calif., to determine annual water and sediment discharge at base-line conditions that are representative of a basin prior to urbanization. Results of the first 3 years of the study (1973-75) are given in this report. Climatic conditions during this period were representative of a very wet year (1973) and 2 years of above-average rainfall (1974 and 1975). Daily water and sediment discharge were monitored at three primary stations, and periodic measurements were made at five secondary stations during selected storms. Most of the total annual sediment discharge at each station was transported during a few days each year. Maximum daily sediment discharge in a given year ranged from 23 to 62 percent of the annual total. Daily water discharge at the gaging station Calabazas Creek at Rainbow Drive, near Cupertino, ranged from no flow to 3.31 cubic meters per second. Streamflow at this location was significantly augmented during low flow by diversion of water from the South Bay Aqueduct. Annual sediment discharge at Calabazas Creek at Rainbow Drive was 4,900 t in 1974 and 9,570 t in 1975. A large quantity of sediment was trapped in a debris basin at Comer Drive upstream from this station during both years. If this sediment had not been trapped, sediment discharge at the station would have been about 35 percent greater in 1974 and 30 percent greater in 1975. Most of the trapped sediment consists of sand and gravel that would probably have been deposited in the Calabazas Creek channel downstream from the station. (Woodard-USGS) W78-12738

#### COMPREHENSIVE BASIN STUDY. RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, TEXAS. VOLUME 3, APPENDIX V: UPSTREAM WATERSHED PROTECTION, USE, MANAGEMENT, AND DEVELOPMENT.

For primary bibliographic entry see Field 6B. W78-12762

#### BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY. VOLUME II, ANNEX A: AGRICULTURAL REQUIREMENTS AND UPSTREAM WATERSHED DEVELOPMENT.

For primary bibliographic entry see Field 6B. W78-12769

#### BIG BLACK RIVER, MS: COMPREHENSIVE BASIN STUDY: VOL. IV, AN. C--RECREATION ASPECTS: AN. D--FISH & WILDLIFE RESOURCES: AN. E--MUNICIPAL & INDUSTRIAL WATER SUPPLY & WATER QUALITY CONTROL: AN. F--GEOLOGY & WATER RESOURCES: AN. G--ARCHEOLOGICAL, HISTORIC, & NATURAL RESOURCES.

For primary bibliographic entry see Field 6B. W78-12771

#### GROUND-WATER USE FOR NUCLEAR POWER PLANTS.

Bechtel, Inc., Gaithersburg, MD. For primary bibliographic entry see Field 3E. W78-12844

#### CONTROLLING DUST IN THE MOHAVE VALLEY.

Arizona Agricultural Experiment Station, Tucson.

A. D. Halderman. Agricultural Engineering, Vol. 59, No. 2, p 25-26, Feb. 1978. 2 photos.

Descriptors: \*Soil management, \*Dust, \*Air pollution, \*Wind erosion, Indian reservations, Soil erosion, Land reclamation, Grading, Soil conservation, Water conservation, \*Arizona, \*Colorado River, \*Mohave Valley(Ariz).

Land grading to adapt Indian lands for irrigated farming along the Colorado River in Mohave County, Arizona, has created dust problems severe enough to close schools and alarm health authorities. Between the removal of vegetation and the establishment of a crop, the land is particularly vulnerable to blowing. Members of the University of Arizona Department of Soils, Water and Engineering have offered several recommendations to alleviate the problem: Limiting the amount of land graded at any one time, coordinating clearing operations with prevailing winds to avoid blowing toward urban and commercial centers, digging wells to wet the land after brush removal and before grading, and the establishment of crops as soon as possible after grading. These recommendations can be adapted to local conditions and are presently being implemented. (Tickes-Arizona) W78-12934

## 5. WATER QUALITY MANAGEMENT AND PROTECTION

### 5A. Identification Of Pollutants

#### CARBON CONTENTS AND SOURCES IN GROUND WATERS OF THE CENTRAL PLATTE REGION IN NEBRASKA.

Nebraska Univ., Lincoln. Conservation and Survey Div. R. F. Spalding, J. R. Gormly, and K. G. Nash. Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 723, Price codes: A02 in paper copy, A01 in microfiche. Journal of Environmental Quality, Vol. 7, No. 3, p 428-434, July-Sept 1978. 2 fig, 3 tab, 23 ref. OWRT A-047-NEB(2).

Descriptors: \*Groundwater, \*Dissolved oxygen, \*Dissolved organic carbon, \*Carbon, \*Nebraska, Central Platte River region(Neb), Sampling, Water analysis, Pollutant identification, \*Platte River(Neb), \*Alkalinity, Water chemistry, Water wells, Land use.

Fifty-one ground water samples collected in a losing reach of the Platte River were analyzed for alkalinity, dissolved oxygen (DO), and dissolved organic carbon (DOC). Ranges in concentrations were 24.8 to 109 mg/liter, 0 to 5.5 mg/liter, and 0.5 to 4.8 mg/liter for organic carbon, DO, DOC, respectively. The concentrations of these constituents are primarily associated with land use and well depth. Carbon isotope fractionation can be useful in determining sources of organic carbon to the ground water. W78-12103

#### ANALYSIS FOR POLYCHLORINATED BIPHENYLS IN LAKE MACATAWA BOTTOM SEDIMENTS.

Hope Coll., Holland, MI. Dept. of Chemistry. I. J. Brink. Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 699, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, submitted to the Institute of Water Research, Michigan State University, East Lansing, (June, 1978). 13 p, 1 fig, 2 tab, 5 ref.

Descriptors: \*Polychlorinated biphenyls, Distribution, \*Lake sediments, \*Sediments, Sediment

depth, Sediment location, Water pollution sources, Pollutant identification, Sediment analysis, \*Lake Macatawa(Mich), Holland(Mich).

Forty-one sediment samples from four regions of Lake Macatawa, three of which contain the major spawning and feeding grounds for fish, were analyzed for PCBs by means of gas-liquid chromatography. Attempts to correlate PCB concentrations with sediment location and composition were partially successful. A linear relationship between PCB concentration and percent organic content was found for one sample region. Apparently the most important variable that determines the degree of PCB contamination is the proximity of the sample to point sources. Several possible PCB point sources were identified. The two sample regions located furthest from the most likely point sources had relatively low levels of contamination. Deep water sediments in these two regions had higher PCB concentrations than samples from shallow water. The region of the lake located closest to the major industrial and commercial activity in the greater Holland area had the highest levels of PCB contamination. The results appear to be consistent with the hypothesis that there is slow seepage of PCBs from an old abandoned land-fill site and a disposal site for dredgings. Results of these investigations are compared with those of a somewhat similar study made by the Michigan Department of Natural Resources. W78-12105

#### PROCEDURES FOR MEASURING COUGH (GILL PURGE) RATES OF FISH.

Environmental Research Lab.-Duluth, MN. R. A. Drummond, and R. W. Carlson. Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 091, Price codes: A04 in paper copy, A01 in microfiche. Ecological Research Series, Report EPA 600/3-77-133, December 1977. 47 p, 1 tab, 5 fig, 77 ref, 3 append.

Descriptors: \*Freshwater fish, \*Bioassay, \*Toxicity, \*Methodology, Laboratory tests, Laboratory animals, Fish physiology, Fish behaviors, Water pollution effects, \*Testing procedures, Brook trout, Sunfish, Metals, DDT, Cadmium, Chromium, Lead, Zinc, Copper, Chlorides, Diazinon, Malathion, Lindane, MATC, Maximum acceptable, Toxicant concentration.

The cough (gill purge) is an interruption in the normal ventilatory cycle of fish that serves to clean the gills of accumulated particulate matter. A review of the literature shows that the cough occurs in a variety of freshwater and marine fish; that both mechanical and chemical stimulation apparently can cause fish to increase their cough rates; and that an increase in coughing is a rapid and sensitive endpoint for studying chemicals and effluents. In reviewing the test methods and apparatus for measuring cough rates of fish, we conclude the electrode chamber method offers more potential as a bioassay tool for assessing the respiratory responses of fish due to toxicant exposure. Recommended test procedures, based on our experience, for using the electrode chamber method are given. (EIS-Katz) W78-12131

#### BIOASSAY PROCEDURES FOR THE OCEAN DISPOSAL PERMIT PROGRAM.

Environmental Research Lab., Gulf Breeze, FL. Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 631, Price codes: A08 in paper copy, A01 in microfiche. Report EPA 600/9-78-010, March 1978, 121 p. 23 tab, 16 fig, 131 ref.

Descriptors: \*Methodology, \*Bioassay, \*Laboratory tests, Oysters, Crustaceans, \*Marine fish, Algae, Laboratory equipment, Phytoplankton, Marine animals, Marine fish, Shrimp,



Identification Of Pollutants—Group 5A

Zooplankton, Shrimp, Benthos, Juvenile fish, \*Acetylcholinesterase inhibition assay.

The bioassay procedures given in this manual were developed to provide tests for conducting toxicity evaluations of waste materials considered for ocean disposal under EPA's Ocean Disposal Permit Program. The procedures specify the use of various organisms representing several trophic levels. Both flow-through and static tests are included. Methods given vary in their utility and complexity of performance. The procedures are not intended to be considered "standard methods," but, depending on the judgement of the EPA Regional Administrator responsible for the managing of the permit program, are to be used as reference methods or official methods. This manual is a revision of EPA 600/9-76-010 published May 1976. (See W77-00041) (EIS-Katz) W78-12132

**BENZO(A)PYRENE METABOLISM IN THE AMERICAN OYSTER CRASSOSTREA VIRGINICA,**  
Sloan-Kettering Inst. for Cancer Research, Rye, NY. Donald S. Walker Lab.  
For primary bibliographic entry see Field 5C. W78-12133

**BIOLOGICAL EFFECTS OF PESTICIDES ON THE DUNGENESS CRAB,**  
Oregon State Univ., Newport. Marine Science Center.  
For primary bibliographic entry see Field 5C. W78-12134

**DESIGN CONSIDERATIONS FOR AMBIENT STREAM QUALITY MONITORING,**  
Washington Univ., Seattle. Dept. of Civil Engineering.  
D. P. Lettenmaier.  
Water Resources Bulletin, Vol. 14, No. 4, p 884-902, August 1978. 3 fig, 5 tab, 21 ref. NSF DEB74-20744 A02.

Descriptors: \*Monitoring, \*Water quality, \*Network design, \*Mathematical models, Networks, Sampling, Streams, Pollutants, Statistics, Statistical models, Statistical methods, Water sampling, Water pollution, Sample size, Sampling frequency.

Existing ambient water quality monitoring programs have resulted in data which are often unsuitable for assessment of water quality trends. A primary concern in designing a stream quality monitoring network is the selection of a temporal sampling strategy. It is extremely important that data for trend assessment be collected uniformly in time. Greatly superior trend detection power results for such a strategy as compared to stratified sampling strategies. In general, it is desirable that sampling frequencies be at least monthly but not greater than biweekly; higher sampling frequencies usually result in little additional information. An upper limit on trend detectability exists such that for both 5 and 10 year base periods it is often impossible to detect trends in time series where the ratio of the trend magnitude to time series standard deviation is less than about 0.5. For the same record lengths, trends in records with trend to standard deviation ratios greater than about one usually can be detected with very high power when a uniform sampling strategy is followed. (Sims-ISWS) W78-12154

**ESTABLISHING BASELINE DATA FOR MANAGEMENT OF HALIFAX, N.S., LAKE WATERSHEDS,**  
Nova Scotia Technical Coll., Halifax. Dept. of Civil Engineering.  
D. Thirumathi, and K. H. Tan.

Journal of the American Water Works Association, Vol. 70, No. 8, p 436-445, August 1978. 14 fig, 10 tab, 24 ref. NRCC A4358.

Descriptors: \*Baseline studies, \*Water quality, \*Lakes, \*On-site data collections, \*Water supply, Basic data collections, Data collections, Watersheds(Basins), Turbidity, Water analysis, Precipitation(Atmospheric), Sodium, Nitrates, Nitrites, Potassium, Chlorides, Coliforms, Magnesium, Sulfates, Iron, Phosphates, Dissolved oxygen, Manganese, Water temperature, Stratification, Foreign countries, \*Nova Scotia, \*Halifax(Nova Scotia), Total organic carbon.

As pressure increased to open protected municipal watersheds for public access and recreational development, a more complete understanding of the effects of watershed use on water quality becomes imperative. The data presented detailed the impact of limited watershed activities on four once-protected water supply lakes near Halifax, Nova Scotia. A comparison of extensive analyses of water samples obtained in 1975 and 1976 with earlier data suggested that relaxation in control of watershed management could lead to deterioration in water quality of the 4 lakes. During a 5-year period of limited watershed activities, chloride, sodium, and conductivity increased steadily; in one lake, nutrient levels became critical enough to cause algal blooms in summer and to initiate a change from oligotrophic to mesotrophic level. The data were suggested as a baseline for assessing the impact of further release of the watersheds following on a switch to another source of water supply. (Humphreys-ISWS) W78-12159

**NUCLEAR TECHNIQUES APPLICABLE TO STUDIES OF POLLUTANTS IN GROUND WATER,**  
Battelle Pacific Northwest Labs., Richland, WA. N. A. Wogman.  
Preprint Paper for a Conference held at Krakow (Poland), December 6-10, 1976. 36 p, 12 fig, 9 tab, 26 ref.

Descriptors: \*Pollutants, \*Groundwater, \*Analytical techniques, \*Pollutant identification, Equipment, Instrumentation, X-ray fluorescence, Neutron activation analysis, Radioisotopes, Tracers, Spectrometers, Mass spectrometry, Gamma rays, Laboratory tests, On-site investigations, Water pollution, \*Nuclear techniques.

This paper summarized the current nuclear methods which can be used for the analysis of inorganic pollutants or tracers, including radioactive species in sediments and in their associated atmospheric and aqueous media. Nuclear techniques allow many trace elements to be analyzed in the ppm to ppb range in both field and laboratory experiments. For direct in situ field measurements, techniques of X-ray fluorescence and neutron activation analysis were discussed. Direct instrumental techniques, as well as chemical procedures enhancing their effectiveness, were discussed as they are applied in laboratory analysis. Radioactive pollutants or tracers can be measured through radiative emissions under laboratory and field conditions. In the laboratory, a few disintegrations per minute can be measured in thousand-gallon water volumes through the use of preanalysis concentration methods. Laboratory instrumentation discussed included X-ray fluorescence analyzers, total absorption gamma ray spectrometry, multidimensional coincidence gamma ray spectrometry, multidimensional gamma ray spectrometry with beta coincidence, dual Ge(Li) antineutrino coincidence systems, as well as single Ge(Li) and NaI(Tl)-Ge(Li) coincidence gamma ray spectrometers. Detection sensitivities for radioisotopes from fallout and those produced by neutron activation analysis methods were presented. (Sims-ISWS) W78-12168

**IDENTIFICATION OF OIL SLICKS BY INFRARED SPECTROSCOPY,**  
Rhode Island Univ., Kingston. Dept. of Chemistry.  
C. W. Brown, P. F. Lynch, and M. Ahmadjian.  
Report to Coast Guard Office of Research and Development Final Report No CG-D-19-77, August 1976. 299 p, 52 fig, 25 tab, 28 ref, 4 append. DOT-CG-81-74-1099.

Descriptors: \*Pollutant identification, \*Oil spills, Water pollution sources, Methodology, Rhode Island, \*Spectroscopy, \*Analytical techniques, Outer Continental Shelf, \*Infrared spectroscopy.

An investigation was undertaken by the University of Rhode Island to evaluate the applicability of infrared spectroscopy to identify sources of oil spills, using computer methods for matching spectra. Eighty-five different oils of all types were weathered for two weeks in at least two of four weathering grids. Two of the grids were located on Narragansett Bay and two at the Kingston laboratory. Spectral data on approximately 900 weathered oil samples were digitized and stored in computer data files to form a library of weathered oils. These were then compared to some 300 spectra of their unweathered sources by a computer ratio method. The investigation showed that infrared spectroscopy coupled with computer analysis is a useful technique for identifying the source of spilled oil. By using artificial weathering techniques, the correct source of a spill can be identified by infrared with a high probability when samples are collected within one week of the original spill. (Sinha-OEIS) W78-12172

**INFRARED ANALYSIS TECHNIQUES FOR OIL IDENTIFICATION,**  
Department of Energy, Bartlesville, OK. Bartlesville Energy Research Center.  
P. L. Grizzle, and H. J. Coleman.  
Available from the National Technical Information Service, Springfield, VA 22161 as BERC-RI-77-4. Price codes: A02 in paper copy, A01 in microfiche. Report No BERC/RI-77-4, April 1977. 22 p, 1 fig, 9 tab, 39 ref.

Descriptors: \*Pollutant identification, \*Oil spills, \*Water pollution, Oil pollution, Baseline studies, Methodology, Outer Continental Shelf, \*Infrared analysis, Crude oil, Resources management.

Infrared (IR) absorbance data at 14 selected frequencies were obtained for 52 crude oils and 52 corresponding topped (distilled through 275°C) crude oil samples. Statistical analysis of the absorbance data justifies the use of 12 of these frequencies for the identification of weathered (topped) crude oils as well as unweathered crude oil samples. Detailed comparison of the IR absorbances at each frequency for 46 pairs of crude oils and corresponding topped crude oil samples indicates that, on the average, the magnitude of these bands will change by approximately 9% upon weathering and that changes as large as 21% can and, in general, will occur. Comparative absorbance data analysis of a group of artificially weathered and unweathered crude oil samples from a common geographical location indicates that spectrally similar unweathered crude oils can be differentiated by IR analysis. Results also suggest that unweathered reference crude oil samples should be artificially weathered by a consistently reliable weathering procedure before comparative analysis to a weathered spilled sample. (Sinha-OEIS) W78-12177

**OIL SPILL IDENTIFICATION SYSTEM.**  
Coast Guard Research and Development Center, Groton, CT.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A044750. Price codes: A10 in paper copy, A01 in

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

microfiche. Report No. CG-D-52-77, June 1977. 205 p.

Descriptors: \*Pollutant identification, \*Water pollution, \*Oil spills, \*Methodology, Gas chromatography, Fluorescence, Spectrophotometry, Baseline studies, Environmental effects, Outer Continental Shelf.

A report titled 'Oil Spill Identification System' was issued in October 1974 detailing all aspects of spill identification as conducted by the Coast Guard R&DC Chemistry Branch. Six of 'first generation' methods have been revised to incorporate the latest techniques developed by the R&DC. These include sampling, sampling handling and transmittal, gas chromatography, fluorescence and infrared spectrophotometry, and thin-layer chromatography. These methods are detailed as they will be used by the Coast Guard operational laboratory. In addition, back-up techniques of low temperature luminescence and high pressure liquid chromatography are included. An infrared field manual and an infrared field classification manual are included, along with a technique for simulated weathering of oils and a section on safety precautions. (Sinha-OEIS) W78-12181

#### DEVELOPMENT OF A SIMPLE, RAPID FIELD TECHNIQUE FOR ESTIMATING OIL CONCENTRATIONS IN THE SEDIMENTS, MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. L. R. Brown.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 976. Price codes: A03 in paper copy, A01 in microfiche. Report to Coast Guard Office of Research and Development Report No. CG-D-27-77, April 1977. 29 p, 2 fig, 3 tab, 2 ref, append. DOT-CG-81-76-1476.

Descriptors: \*Pollutant identification, \*Oil pollution, Water pollution effects, \*Oil spills, \*Sediments, \*Chromatography, Gulf of Mexico, Environmental effects, Resources development, Outer Continental Shelf, Argo Merchant.

A rapid method for estimating the relative concentration of oil in sediments was developed and may effectively be employed in the field by non-technical personnel. The method employs a TLC (thin-layer chromatographic) technique to concentrate, rather than separate, the fluorescent compounds in oil in one area of the chromatogram. The limit of detection on the chromatogram is 2 micrograms of Empire Mix or Saudi Arabian crude oil. It is a rapid, inexpensive field method for locating areas where the sediments contain oil and for estimating the relative amount of oil in comparison to adjacent areas. (Sinha-OEIS) W78-12182

#### FLOW-THROUGH MICROCOSMS FOR SIMULATION OF MARINE ECOSYSTEMS: DEVELOPMENT AND INTERCOMPARISON OF OPEN COAST AND BAY FACILITIES, Naval Undersea Center, Kailua, HI. Div. of Chemistry and Environmental Sciences. For primary bibliographic entry see Field 5G. W78-12189

AN INTRODUCTION TO THE LIMNOLOGY OF THE FRIESIAN LAKES, Limnological Inst., Oosterzee (Netherlands). Tjeukemeer Field Station. D. M. Beattie, H. L. Golterman, and J. Vijverberg. Hydrobiologia, Vol. 58, No. 1, p 49-64, 1978. 9 fig, 7 tab, 47 ref.

Descriptors: \*Friesian Lake District (Netherlands), \*Lakes, \*Limnology, \*Eutrophication, \*Zooplankton, \*Chlorophyll, Benthic fauna, Water chemistry, Hydrology, Lake morphology, Color, Seasonal, Species composition,

Netherlands, Leijen (Netherlands), Bergummeer (Netherlands), Princenhof (Netherlands), Pikmeer (Netherlands), Sneekermeer (Netherlands), Langweerder Wielen (Netherlands), dermeer (Netherlands), Heegermeer (Netherlands), Fluessen (Netherlands), Morra (Netherlands), Slotmeer (Netherlands), Brandemeer (Netherlands), Grote Brekken (Netherlands), Tjeukemeer (Netherlands).

Fourteen lakes in the Friesian Lake District, the Netherlands, were sampled November 1970-November 1972 to determine chemical composition, chlorophyll-a content, and zooplankton and benthic faunal species composition and population densities. Analysis of results in relation to the hydrology of the overall system of lakes and to the morphometry of the individual lakes showed them to be so similar as to be regarded as one large lake. Chlorophyll-a concentrations indicated eutrophic conditions in all lakes, though lakes in the south had higher concentrations than those in the northeast (except Leijen). Lakes studied were Leijen, Bergummeer, Princenhof, Pikmeer, Sneekermeer (north and south), Langweerder Wielen, Koevordermeer, Heegermeer, Fluessen (north and south), Morra, Slotmeer, Brandemeer, Grote Brekken, and Tjeukemeer. The lakes, which act as water reservoirs for surrounding polders, are interconnected by canals. Brown color measurements gave a slightly better indication of water movements than chloride. Cladoceran zooplankton densities correlated strongly with chlorophyll-a, except in the Fluessen complex. Density of Chironomus plumosus larvae was used as the basis for a classification of the lakes, as variations in density were ascribed to combined effects of wind and lake morphometry. Chemical analyses included phosphate, chloride, silicon, iron, chlorophyll-a, and brown color intensity. (Lynch-Wisconsin) W78-12202

#### COMPARATIVE FINE-STRUCTURAL STUDIES ON FIVE MARINE SPECIES OF PYRAMIMONAS (CHLOROPHYTA, PRASINOPHYCEAE), Washington Univ., Friday Harbor. Friday Harbor Labs. For primary bibliographic entry see Field 5C. W78-12207

AN ASSESSMENT OF PRINCIPAL COMPONENT ANALYSIS FOR DESCRIPTION OF PHYTOPLANKTON PERIODICITY IN LAKE WINGRA, Wisconsin Univ.-Madison. Lab. of Limnology. For primary bibliographic entry see Field 5C. W78-12209

#### DETERMINATION OF CADMIUM IN WATERS OF THE STATE OF PIAUI, BRAZIL (DETERMINACAO DE CADMIO EM AGUAS DO ESTADO DO PIAUI, BRASIL), Ceara Univ., Fortaleza (Brazil). Centro de Ciencias. For primary bibliographic entry see Field 2K. W78-12213

DETERMINATION OF IRON, MANGANESE, COPPER AND ZINC IN WATERS OF THE STATE OF PIAUI, BRAZIL (DETERMINACAO DE FERRO, MANGANESE, COBRE E ZINCO EM AGUAS DO ESTADO DO PIAUI, BRASIL), Ceara Univ., Fortaleza (Brazil). Centro de Ciencias. For primary bibliographic entry see Field 2K. W78-12214

#### DETERMINATION OF BORON IN WATERS OF THE STATE OF PIAUI, BRAZIL

(DETERMINACAO DE BORO EM AGUAS DO ESTADO DO PIAUI, BRAZIL), Ceara Univ., Fortaleza (Brazil). For primary bibliographic entry see Field 2K. W78-12215

#### SAMPLING FREQUENCY FOR RIVER QUALITY MONITORING, Colorado State Univ., Fort Collins. Dept. of Civil Engineering. T. G. Sanders, and D. D. Adrian. Water Resources Research, Vol 14, No 4, p 569-576, 1978. 5 fig, 3 tab, 25 ref.

Descriptors: \*Sampling, \*Monitoring, \*Water quality, Water quality, Control, Water analysis, Statistical methods, Chemical analysis, River basins, River flow, Mathematical models, On-site data collections, \*Connecticut River.

Sampling frequency for a water quality monitoring network is presented, and for illustrative purposes the criterion is applied to the Massachusetts portion of the Connecticut River basin. The proposed frequency criterion is based upon the assumption that the primary objectives of future river quality monitoring networks are the determination of ambient water quality conditions and an assessment of yearly trends rather than detection of stream or effluent standards violations. The sampling frequency criterion is derived as a function of the random variability of the river flow. The criterion is specifically related to the magnitude of the expected half width of the confidence interval of the mean of the random component of the annual statistic—mean log river flow. The appropriate sampling intervals (at each sampling station within the river basin) are determined by specifying equality of this confidence interval half width, which insures a uniform reliability of the annual statistic. (EIS-Deal) W78-12239

#### THE USE OF FISH AS A BIOLOGICAL SENSOR FOR TOXIC COMPOUNDS IN POTABLE WATER, Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research. W. S. G. Morgan. Progress in Water Technology, Vol. 10, No. 1-2, p 395-398, 1978. 1 tab, 7 ref.

Descriptors: \*Bioindicators, \*Monitoring, \*Automatic control, \*Potable water, Water quality, Fish behavior, Water quality control, Public health, Water analysis, Physicochemical properties, Automation, Pollutant identification, Toxicity, Methodology, \*Opercular rhythms.

Rapid, continuous, biological monitoring systems, intended to complement physical-chemical surveillance, have been developed to utilize increases in fish opercular rhythms and activity. Any increase above the rates to be expected under normal conditions is monitored electronically. Built-in, visual alarm systems provide advance warning of imminent conditions that may be deleterious to public health. (EIS-Deal) W78-12241

#### PHYTOPLANKTON SAMPLING IN QUANTITATIVE BASELINE AND MONITORING PROGRAMS, Virginia Inst. of Marine Science, Gloucester Point. P. E. Stofan, and G. C. Grant. Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 644. Price codes: A05 in paper copy, A01 in microfiche. Publication No. EPA-600/3-78-025, February 1978. 83 p, 166 ref. R804147010.

Descriptors: \*Phytoplankton, \*Methodology, \*Monitoring, \*Sampling, \*Baseline studies, \*Basic data collections, Algae, Bibliographies, Ecology,

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Identification Of Pollutants—Group 5A

Carbon radioisotopes, Chlorophyll, Estuaries, Oceans, Eutrophication, Research equipment.

An overview of methods for phytoplankton sampling, sample treatment, and sample analysis is presented, along with an extensive bibliography. The complexity of dynamic oceanic and estuarine ecosystems precludes prescription of a detailed and concise guideline for baseline or monitoring surveys. However, various general recommendations include: (1) Divide the investigative area into hydrographic subareas, and overlay them with a grid to provide a statistically valid sampling basis. (2) Sample at weekly to monthly intervals in estuarine systems, and biweekly to bimonthly in ocean environments. (3) Intensify sampling following ecosystem disturbances. (4) Subsurface bottle sampling is most efficient in eutrophic waters with high phytoplankton densities, a net or pump sampler may be preferable for oligotrophic ocean areas, while screens well-suited for surface sampling. (5) The Utermohl enumeration method is the most widely used because it provides a wide range of adaptability at medium cost; conventional live analysis should also be performed on sample aliquots. (6) Phytoplankton analysis in a general baseline survey should be accompanied by a wide array of ancillary data, including delineation of zooplankton, ichthyoplankton, and benthic communities. (7) Carbon-14 is the usual productivity estimate. (8) Chlorophyll-a is a good measure of standing stock. Several data storage banks were searched for this study to determine the current status of phytoplankton surveys. (Lynch-Wisconsin)

W78-12247

### GUIDELINES FOR ZOOPLANKTON SAMPLING IN QUANTITATIVE BASELINE AND MONITORING PROGRAMS,

Virginia Inst. of Marine Science, Gloucester Point. F. Jacobs, and G. C. Grant.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 151, Price codes: A04 in paper copy, A01 in microfiche. Publication No. EPA-600/3-78-026, February 1978. 51 p. R804147010.

Descriptors: Pollutant identification, \*Zooplankton, \*Methodology, \*Baseline studies, \*Monitoring, \*Sampling, \*Basic data collections, Bibliographies, Statistical methods, Research equipment, Nets, Pumps, Transects, Preservation, Data processing.

Methods of zooplankton sampling and analysis for quantitative baseline and monitoring surveys are described and evaluated. Zooplankton exhibit wide spatial, diurnal, and seasonal variations which, along with gear bias and capture avoidance, complicate data collecting and subsequent assessment of relationships. This study concludes: (1) Baseline studies require more frequent sampling and closely spaced stations than do monitoring studies. (2) Sampling locations can be further apart in homogeneous waters, while in heterogeneous coastal or estuarine water sites should be more closely spaced and sampling conducted more frequently. (3) Sampling sites can be selected by means of a grid overlaid on the study area, though transects may be used with study areas which cover great distances and when ship time is limited. (4) In pollution studies a series of transect lines radiating from a single source may be advisable. (5) Pumping systems are an expensive but efficient means of capturing microzooplankton; a rate exceeding 150 liters/min is necessary to minimize avoidance. (6) Nets with mouth openings of 50-100 cm diameter are recommended for most groups of mesozooplankton. (7) In areas of high plankton density, a 333-micrometer mesh is preferable. (8) Specimens are generally best preserved in 4% buffered formaldehyde. (9) The Folsom and Burrell splitters are suggested. Statistical methods of analysis are discussed, and a bibliography is provided. (Lynch-Wisconsin)

W78-12249

### WATER QUALITY DATA, MANITOBA, 1961-1976.

Department of the Environment, Ottawa (Ontario). Water Resources Branch. 1978, in English and French.

Descriptors: \*Water quality, \*Data collections, Water temperature, Flow, Discharge(Water), Gaging stations, Statistics, Pollutant identification, Canada, \*Manitoba, \*National Water Quality Data Bank(NAQUADAT), Hydrometric data, 1961 to 1976.

This report presents, in table form, Water Quality Data for the province of Manitoba for the years 1961 to 1973. These data have been determined in Water Quality Branch laboratories as part of the National Water Quality Monitoring Program. This summary of Water Quality Data contains information on water temperature, water flow and discharge for various specific locations within Manitoba. A guide to the use of the tables is included in the report. (WATDOC)

W78-12255

### INTERLABORATORY QUALITY CONTROL STUDY NO. 16, TOTAL MERCURY IN NATURAL WATERS,

Canada Centre for Inland Waters Burlington (Ontario).

K. I. Aspila, and J. M. Carron.

Report Series No. 53, 1978, 19 p. 11 fig. 4 tab. 2 append.

Descriptors: \*Laboratory tests, \*Mercury, \*Quality control, \*Water sampling, Water properties, Data collections, \*Analytical techniques, \*Pollutant identification.

This study was designed to obtain information on the compatibility of mercury data generated by 25 laboratories using a variety of different methods. It was conducted from April to July of 1976. Test samples were provided as dilute solutions ready for analysis. The samples included one distilled water blank, one unspiked natural water and five fortified natural waters. Youden and standard addition plots were employed to describe the results. A comparison of in-laboratory and between-laboratory precision is given. (WATDOC)

W78-12259

### THE ESTIMATION OF SAMPLE SIZE REQUIRED IN CHEMICAL LIMNOLOGY AND AUTECOLOGY OF SHELLED INVERTEBRATES,

Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 7B.

W78-12262

### ENRICHMENT OF ANIONS OF WEAK ACIDS BY DONNAN DIALYSIS,

Southern Illinois Univ. at Carbondale. Dept. of Chemistry and Biochemistry.

J. A. Cox, and K. H. Cheng. Analytical Chemistry, Vol 50, Apr 1978, p 601-602, 3 tab, 6 ref. OWRT A-087-ILL(3).

Descriptors: \*Ion exchange, \*Chemical analysis, Membrane processes, \*Anion exchanges, \*Dialysis, \*Acids, Weak acids, \*Donnan Dialysis, Electrolytes.

The rate of Donnan Dialysis enrichment of weak acids was found to be influenced by the pH of the sample and of the receiver electrolyte; however, when the receiver pH is much less than the pK of the most acidic species, the transfer rate is independent of sample pH over a wide range. Under optimum conditions, the enrichment rate of several anions is identical. These results suggest that diffusion of the sample anion is not the rate-determining step in these enrichments and, further, that the rate of transfer across the membrane/receiver interface is especially important.

W78-12266

### DISSOLUTION OF ARSENIC FROM WATER-LOGGED AND AERATED SOIL,

Missouri Univ.-Columbia. Dept. of Agronomy.

For primary bibliographic entry see Field 5B.

W78-12267

### THE POLLUTION OF NATURAL RIVER BED SEDIMENTS BEHIND THE SAVA RIVER ARTIFICIAL DAM (IN SLOVENIAN),

M. Aznik, F. Megusar, and J. Stern.

Zb Bioteh Fak Univ Ljublj Kmetijstvo 26, p 165-178, 1978.

Descriptors: \*Lake sediments, Water pollution, Impoundments, Iron, Zinc, Lead, Manganese, \*Metals, Aquatic fauna, \*Bacteria, Microbes, Pseudomonas-fluorescens, Yugoslavia.

The mechanical composition, general chemical properties, Fe, Mn, Zn and Pb content, exchange state and capacity of colloidal particles, population density of bacterial saprophytes and the state of microbial cells together with some biochemical activities of the river bed sediments deposited over a period of 10 years behind the artificial dam of the river Sava (Yugoslavia) are presented and discussed. The non-polluted sediments from the nearby artificial water accumulation are utilized as a blank. A bioassay with *Pseudomonas fluorescens* as a test organism is utilized to estimate the possible toxic effect of water extractable fraction of the sediments. The possible utilization of the sediments as substrate for growing plants and probable causes for fatal effect on water fauna during the downstream transportation of material to clean the river bottom are also discussed. Copyright 1978, Biological Abstracts, Inc.

W78-12271

### SALMONELLA SEROTYPES ISOLATED FROM THE AQUATIC ENVIRONMENT (WABASH RIVER, INDIANA, 1973-1976),

Purdue Univ., Lafayette, IN. Dept. of Veterinary Microbiology, Pathology and Public Health.

For primary bibliographic entry see Field 5C.

W78-12272

### EXPERIMENTAL SALMONELLA INFECTIONS IN CRASSIUS AURATUS (GOLDFISH),

Purdue Univ., Lafayette, IN. Dept. of Veterinary Microbiology, Pathology, and Public Health.

For primary bibliographic entry see Field 5C.

W78-12273

### COLUMN CHROMATOGRAPHY FOR FIELD PRE-CONCENTRATION OF TRACE METALS,

North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.

M. S. Shuman, and J. H. Dempsey. Journal Water Pollution Control Federation, Sept. 1977, p 2001-2006. 3 fig. 2 tab, 10 ref. OWRT A-073-NC(4), 14-31-0001-5033.

Descriptors: \*Chromatography, \*Trace elements, Metals, \*Heavy metals, Ion exchange, Adsorption, Analytical technique, Cadmium, Chromium, Copper, Mercury, Zinc, \*Pollutant identification, \*Trace metals, Dissolved trace metals, Ion exchange column, Resins, Haw River(NC), \*North Carolina, Cape Fear River(NC).

Column Chromatography was investigated for adaptation as a field technique for concentrating dissolved trace metals from natural waters. Manganese oxide impregnated acrylic fibers, a chelating resin (Chelex 100), a cation exchange resin (AG-50W) and an anion exchange resin (AG-1) were employed in preliminary work. Ion exchange resins were found to be the most satisfactory and the final design for field use consisted of a cation and an anion exchange column in series. Natural



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

water spiked with CR51 as a tracer indicated that soluble Cr (III) and Cr (IV) could be separated by the technique. A portable field unit was constructed and used to carry out a one-year survey of Cd, Cr, Cu, Pb, and Zn in the Haw-Cape Fear Rivers of North Carolina. Elevated concentrations of Cr, Cu, and Cd were observed in the upper industrialized areas while Zn and Pb appeared to have sources throughout the basin. Concentration ranges in ug/l were <0.10-1.22 Cd, <0.1-26.8 Cr, 0.9-9.1 Cu, 1.1-74.0 Pb, and 2.9-74.0 Zn. (Kiger-NC State)  
W78-12275

**CHARACTERISTICS OF PREDICTING SANITARY CONDITIONS OF WATER USE BY THE POPULATION IN NEW ECONOMIC AREAS IN THE EXAMPLE OF THE CENTRAL REGION OF THE BAIKAL-AMUR RAILWAY (IN RUSSIAN),** Nauchno-Issledovatel'skii Inst. Gigeny, Moscow. For primary bibliographic entry see Field 5C.  
W78-12284

**INVESTIGATION ON DRILLING CORES OF SEDIMENTS OF LAKE CONSTANCE: I. PROFILES OF THE POLYCYCLIC AROMATIC HYDROCARBONS (IN GERMAN),** Biochemisches Inst. Umweltcarcinogene, Ahrensburg (West Germany). G. Grimmer, and H. Boehnke. Z Naturforsch Sect C Biosci 32(9/10), p 703-711, 1977.

Descriptors: West Germany, \*Lake sediments, \*Lake Constance(W Germany), \*Drilling cores, \*Aromatic hydrocarbons(Polycyclic), Organic compounds, \*Pollutant identification.

The content of polycyclic aromatic hydrocarbons (PAH) from sediment layers of Bodensee (West Germany) areas differently exposed to environmental burden were determined; 32 PAH and 10 N containing PAH were identified by comparison with authentic samples. A method of quantitative enrichment and gas chromatographic determination to PAH containing 4-7 rings is described. In a comparative profile analysis only the 20 most abundant PAH were regarded. Low burdened areas (center of the lake, 250 m deep; Güttingen) show only 10-20% of the PAH content of high-burdened areas (mouth of Argen and Schussen). The qualitative and quantitative composition of the PAH fraction (PAH-profile) from different layers of a sediment drilling core are very similar, whereas profiles from different regions can be distinguished. The concentration of PAH increased from the surface to a layer with maximum burden (1965-1970) and then decreased to a remaining concentration (1900). From the typical PAH profile and some characteristic compounds, e.g., benzo(b)-naphtho(2,1-d)thiophan, benz(a,c)acridines, benzo(a,b/c)-carbazoles, dibenzacridines and dibenzcarbazoles some potential sources such as car traffic, petroleum, fuel oil and used lubricating oil can be excluded. Coal combustion smoke gas is probably the main source of emission.--Copyright 1978, Biological Abstracts, Inc.  
W78-12290

**TOXIC EFFECT OF COPPER STUDIED BY ELECTRO-CARDIOGRAM IN CARP (CYPRINUS CARPIO) (IN FRENCH),** Ecole National Supérieure Agronomique de Toulouse (France). Lab. de Ichtyologie Appliquée. For primary bibliographic entry see Field 5C.  
W78-12293

**QUANTITATIVE DETERMINATION OF THE TOXICITY OF DIFFERENT AGENTS USING CHLORELLA AS A TEST OBJECT (IN RUSSIAN),** Mosc. Sewage Res. Proj. Inst., Moscow, USSR. G. K. Barashkov, and N. M. Kiristaeva.

Gidrobiol Zh 13(2), p 104-108, 1977.

Descriptors: \*Chlorella-Pyrenoidosa, Sewage, Water pollution, \*Toxicity tests, \*Pollutant identification, Methodology, Algae.

A simple method for determining the toxicity of substances in sewage or natural waters using a mesophilic Chlorella pyrenoidosa culture is described. The sensitivity of the determination was increased by transferring the algae from 1 type of medium to another, and the use of ultrasound treatment increased accuracy. An internal standard of toxicity based on copper sulfate can be used for relative toxicity studies. The method is recommended for water quality studies.--Copyright 1978, Biological Abstracts, Inc.  
W78-12294

**HYGIENIC ASSESSMENT OF AN ANTICORROSION HERMETIC AH-4 USED IN A HOT WATER SUPPLY SYSTEM (IN RUSSIAN),** Nauchno-Issledovatel'skii Inst. Gigeny, Moscow. Yu. V. Novikov, and K. O. Lastochkina. Gig Sanit (11), p 26-32, 1976.

Descriptors: \*Potable water, \*Water supply, \*Water quality standards, Toxicity, Public health, Corrosion control, Water treatment, \*Pollutant identification.

A complex of sanitary-chemical and toxicologic investigations were carried out on the quality and the biological properties of water, that was in contact with hermetic AH-4. After contact the properties of water (smell, taste, transparency, color and pH) corresponded to the requirements of the state standard for drinking water. No presence of adjuvants could be traced in the water. In experimental investigations no biological action of the water, which was in contact with hermetic AH-4, could be detected under conditions of a chronic test in rats by biochemical, physiological and pathological investigation methods. Based on complex investigation, hermetic AH-4 may be recommended for field use in the hot water supply system.--Copyright 1978, Biological Abstracts, Inc.  
W78-12295

**THE USE OF CARBON AND SULFUR ISOTOPIC RATIOS AND TOTAL SULFUR CONTENT FOR IDENTIFYING THE ORIGIN OF BEACH TARS IN SANTA MONICA BAY, CALIFORNIA,** University of Southern California, Los Angeles. Sea Grant Program. For primary bibliographic entry see Field 5B.  
W78-12311

**ON THE BEACH - INFRARED SPECTROSCOPY IN THE REAL WORLD,** Rhode Island Univ., Kingston. Dept. of Chemistry. C. W. Brown, W. P. Lee, P. F. Lynch, and M. Ahmadjian. Rhode Island University Marine Reprint No. 104. Reprinted from: Environmental Analysis, p 79-91, 1977. Academic Press, New York. 7 fig, 5 ref. SG-04-6-148-44002.

Descriptors: \*Pollutant identification, Water pollution, Sediments, Sand, Clams, Spectroscopy, Sea water, Analytical techniques, \*Infrared spectroscopy, Hydrocarbons.

Organic extracts of sea water, beach sands, clams and ocean sediments have been analyzed by infrared spectroscopy during a three year study. Over 300 water samples, 37 sand and sediment samples and 12 clam samples were analyzed. Infrared spectra of the extracts were measured after removing the solvent. Furthermore, the spectra were re-measured after separation by TLC, and some were re-measured after saponifying the extracts. The spectra, obtained after removing the solvent, have suggested novel uses of infrared

spectroscopy in marine pollution studies, e.g., various fractions of petroleum and phthalic acid esters can be monitored. Moreover, infrared spectroscopy can be used very effectively to 'screen' samples in order to determine further analysis requirements. (NOAA)  
W78-12322

**'BASELINE MONITORING STUDIES, MISSISSIPPI, ALABAMA, FLORIDA, OUTER CONTINENTAL SHELF, 1975-1976' VOLUME III, RESULTS,** State Univ. System of Florida Inst. of Oceanography, St. Petersburg. For primary bibliographic entry see Field 7C.  
W78-12328

**DETERMINATION OF INDUSTRIAL DYES IN WATER BY LASER EXCITED RESONANCE RAMAN SPECTROMETRY,** Rhode Island Univ., Kingston. Dept. of Chemistry. L. Van Haverbeke, P. F. Lynch, and C. W. Brown. Rhode Island University Marine Reprint No. 103. Reprinted from: Analytical Chemistry, Vol 50, No 2, p 315-317, February 1978. 3 fig, 2 tab, 7 ref. SG-04-6-158-44002.

Descriptors: Water pollution, \*Pollutant identification, \*Dye concentrations, Chemical analysis, Spectrophotometry, Analytical techniques, Raman spectrometry, Industrial dyes.

Industrial fabric dyes were detected in distilled water at concentrations below 100 ppb and identified at concentrations below 200 ppb using resonance Raman spectrometry. The method was tested on doped samples of river and seawater. In both cases dyes could be detected and identified at the 200-ppb level. Detection and identification limits were higher in the natural samples because of an increase in the spectral background; however, the results show that the method is practical for 'real world' samples. (NOAA)  
W78-12330

**DISCHARGE OF ALKANES DURING OFFSHORE OIL PRODUCTION IN THE BUCCANERO OILFIELD,** Houston Univ., TX. Dept. of Biophysical Sciences. For primary bibliographic entry see Field 5B.  
W78-12355

**DEVELOPMENT OF A RAPID FISH TOXICITY TEST UTILIZING A FREEZE CONCENTRATION TECHNIQUE FOR ROUTINE PETROLEUM REFINERY WASTEWATER MONITORING,** Imperial Oil Ltd., Toronto (Canada). E. C. Birchard. Progress in Water Technology, Vol. 9, p 749-759, 1977. 4 tab, 2 app, 13 ref.

Descriptors: \*Bioassay, \*Testing procedures, Analytical techniques, Toxicity, Laboratory tests, Chemical analysis, Chemical properties, Mortality, Rainbow trout, \*Oil, \*Oil pollution, Industrial wastes, Membrane processes, Metals, Methodology, \*Toxicity testing.

Freeze concentration appears to be a viable technique for increasing toxicity of a refinery effluent and thus shortening the time required to elicit an end-point response in a test organism. Concentrating an effluent 5 to 1 by volume reduced equivalent mortality response time from 24 to 5 hours for the standard static bioassay, and from 96 to 13 hours for the standard flow-through bioassay. Further development of the freeze concentration technique may further reduce the response time and mortality may be able to be replaced by sublethal changes to the test organisms. (EIS-Deal)  
W78-12369

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Identification Of Pollutants—Group 5A

**FORMS OF IRON IN RIVER WATERS,**  
Hokkaido Univ., Hakodate (Japan). Lab. of  
Marine Chemistry.  
For primary bibliographic entry see Field 5B.  
W78-12371

**RECENT ADVANCES IN FISH TOXICOLOGY --  
A SYMPOSIUM.**  
Oregon State Univ., Corvallis. Dept. of Fisheries  
and Wildlife.  
For primary bibliographic entry see Field 5C.  
W78-12376

**RELATIONSHIP BETWEEN PH AND ACUTE  
TOXICITY OF FREE CYANIDE AND DIS-  
SOLVED SULFIDE FORMS TO THE FATHEAD  
MINNOW,**  
Minnesota Univ., St. Paul. Dept. of Enterology,  
Fisheries, and Wildlife.  
For primary bibliographic entry see Field 5C.  
W78-12382

**THE ACUTE TOXICITY OF NITRITE TO  
FISHES,**  
Montana State Univ., Bozeman. Fisheries Bioas-  
say Lab.  
For primary bibliographic entry see Field 5C.  
W78-12383

**COPPER TOXICITY: A QUESTION OF FORM,**  
Corvallis Environmental Research Lab., OR.  
Western Fish Toxicology Station.  
For primary bibliographic entry see Field 5C.  
W78-12384

**SOLID WASTES RESEARCH IN SOUTH  
AFRICA,**  
Council for Scientific and Industrial Research,  
Johannesburg (South Africa).  
R. G. Noble.  
South African National Scientific Programmes  
Unit, Report No 4, 1975. 17 ref, 3 tab.

Descriptors: \*Solid wastes, Agricultural wastes,  
Domestic solid wastes, Landfills, Waste disposal,  
Waste paper, Plastics wastes, Guidelines,  
\*Wastes (Research), \*South Africa.

The National Programme for Environmental  
Sciences aims at identifying, evaluating and work-  
ing towards solutions for environmental problems  
through cooperative studies drawing together in-  
terested scientists from various sectors. Apart  
from solid wastes, the National Programme also  
includes research relating to ecosystems, their  
structure, functioning and exploitation and  
disturbance by man. It includes research relating  
to environmental problems in inland waters, ter-  
restrial ecosystems, the sea and lower atmosphere.  
This report reflects the preliminary thoughts of the  
Committee and identifies areas in need of further  
attention. Through the concerted attention of  
cooperating agencies, it is hoped that pollution ef-  
fects arising from the disposal of solid wastes will  
be minimized and that it will contribute to the con-  
servation of natural resources. (So Afr Water Info Ctr)  
W78-12398

**TOXICITY STUDIES ON MARINE ANIMALS,**  
Cape Town Univ. (South Africa). Dept. of Zoolo-  
gy.  
For primary bibliographic entry see Field 5C.  
W78-12424

**SUSPECTED KILLER UNDER THE  
MICROSCOPE.**  
Council for Scientific and Industrial Research,  
Pretoria (South Africa).  
Scientiae, Pretoria, Vol 18, No 1, p 27-28, 1977.

Descriptors: \*Eutrophication, Lentic environ-  
ment, \*Microcystis Aeruginosa, Water quality,  
Toxicity, Algae toxins, Seasonal variations, Elec-  
tron microscopy, Structural analysis, Environ-  
mental aspects, Viruses, \*South Africa.

The cell structure of *Microcystis aeruginosa*, the  
blue-green alga which has been linked with  
sporadic cattle deaths at the Hartbeespoort Dam,  
has been described for the first time. Samples of  
this controversial alga have been examined under  
the electron microscope by a researcher at the  
CSIR's National Institute for Water Research  
(NIWR), but even on such close scrutiny the cause  
of its recurrent toxicity remains elusive. The pri-  
ority for researchers is, however to pinpoint the  
environmental conditions which cause *Maeruginosa*  
to produce a toxic molecule. Once these are  
known, preventive measures can be developed.  
Further study of a basic nature is already in  
progress. (So Afr Water Info Ctr)  
W78-12446

**THE USE OF A SLOTTED QUARTZ TUBE FOR  
THE ANALYSIS OF TRACE METALS IN  
FRESH WATER,**  
Council for Scientific and Industrial Research,  
Pretoria (South Africa).  
R. J. Watling.  
Water South Africa, Vol. 3, No. 4, p 219-220, 1977.  
3 ref, 2 tab, 1 fig.

Descriptors: \*Trace metals, Freshwater, \*Water  
analysis, \*Slotted quartz tube, Equipment evalua-  
tion, Flame atomic absorption spectroscopy, Sen-  
sitivity, Precision, Multielement determination,  
Rapid techniques, Interference, \*Pollutant  
identification, South Africa.

With the growing awareness of the gradual build-  
up of trace metals in the marine and freshwater en-  
vironments it has become increasingly necessary  
to monitor metal levels in water on a regular basis.  
Accordingly, fast and accurate analytical  
techniques are necessary. This paper describes the  
use of a slotted quartz tube (SQT) accessory to a  
conventional flame atomic absorption burner  
whereby significant increases in sensitivity and  
precision have been obtained to enable fourteen  
elements to be determined directly in a fresh water  
matrix. (So Afr Water Info Ctr)  
W78-12494

**TRACE METAL STUDIES IN KNSNA ESTUA-  
RY,**  
Council for Scientific and Industrial Research,  
Pretoria (South Africa).  
R. J. Watling, and H. R. Watling.  
Environment, Republic of South Africa, (Pretoria)  
Vol 2, No 10, p 5-8, 1975. 6 ref, 1 fig, 2 tab.

Descriptors: \*Biomonitoring, \*Trace elements,  
Mollusca, \*Estuarine pollution, Estuarine en-  
vironment, Estuarine sediments, Pollutant  
identification, South Africa, Knysna, *Crassostrea*  
*margaritacea*, *Ostrea Edulis*, *Crassostrea*  
*gigas*.

Knysna estuary is the most biologically productive  
estuary in South Africa, as such, is listed as an  
area of primary importance in the national marine  
monitoring programme. If the estuary should  
become polluted the coastal fishery may be adver-  
sely affected. For these reasons it is necessary to  
make a through study of the current trace metal  
levels which occur in the estuary, to provide  
baseline data against which the effects of any fu-  
ture developments can be measured. Data ob-  
tained from the continued monitoring of trace-  
metal levels in sediments and biological species  
can be used to evaluate the effects of all future  
development in the Knysna estuary, so that when  
necessary, immediate steps may be taken to control  
any pollution. (So Afr Water Info Ctr)  
W78-12509

**MODEL EXPERIMENTS ON POLIOMYELITIS  
SURVEILLANCE IN AN URBAN POPULATION  
OF THE RUHR VALLEY (ESSEN) BY IN-  
VESTIGATIONS OF THE SEWAGE WATER (IN  
GERMAN),**  
Essen Univ. (Gesamthochschule) West Germany).  
Abt. fuer Medizinische Virologie und Immu-  
nologie.  
O. Thraenhart, E. Kuwert, and W. Worringen.  
Zentralbl Bakteriell Parasitenkd Infektionskr Hyg  
Erste Abt Orig Reihe B Hyg Betriebshyg Praev  
Med 164(4), p 328-339, 1977.

Descriptors: \*Ruhr Valley (W Germany),  
\*Viruses, \*Sewage, Domestic wastes, Public  
health, Cities, Water pollution, \*Pollutant identi-  
fication, Kinetics, Picornavirus, \*Poliovirus, Vac-  
cine.

Correlation between viral infections in a popula-  
tion and circulation of the corresponding viruses in  
sewage waters is frequently observed. This in-  
vestigation was directed towards 2 major goals: to  
minimize the time required for virus isolation and  
subsequent characterization of the isolates and to  
control more efficiently the poliovirus circulation  
in sewers of a metropolitan area under field con-  
ditions. On the laboratory level overlap procedures  
of isolation, identification and differentiation  
reduced the time lag between sampling and even-  
tual characterization of poliovirus isolates from  
sewage waters to at least 14 days. In a field of  
poliomyelitis surveillance about 40% of sewage  
waters of a large urban community (Essen, West  
Germany, 290,000 population) were controlled by  
drawing samples at 9 different points in the sewers  
at weekly intervals over 5 mo. of an overall obser-  
vation period of 2 yr. During this time no wild  
poliovirus could be isolated and no case of polio-  
myelitis was observed.--Copyright 1978, Biologi-  
cal Abstracts, Inc.  
W78-12511

**CHEMICAL CHARACTERISTICS OF LAKE  
MARYUT, A POLLUTED LAKE SOUTH OF  
ALEXANDRIA, EGYPT,**  
Alexandria Inst. of Oceanography and Fisheries  
(Egypt).  
S. D. Wahby, S. M. Kinaway, T. I. El-Tabbakh,  
and A. Abdel.  
Estuarine and Coastal Marine Science, Vol 7, p 17-  
28, 1978. 7 fig, 2 tab, 29 ref.

Descriptors: \*Water analysis, \*Oxygen,  
\*Industrial wastes, \*Sewage effluents, Chemical  
analysis, Ammonia, Seasonal coasts, Oxygen de-  
mand, Organic compounds, \*Hydrogen sulphide,  
Water pollution sources, Water pollution effects,  
\*Oxygen consumption, \*Lake Maryut, \*Egypt.

Lake Maryut waters were analysed for chlorosity  
variations, pH, alkalinity, oxygen content, and the  
rate of oxygen consumption, in addition to am-  
monia, hydrogen sulphide and organic matter con-  
tent. The object of the study was to assess the  
degree of water pollution as a probable cause of  
the decrease in fish production. Oxygen content  
showed complete depletion in many months and a  
high rate of oxygen consumption. Organic matter,  
hydrogen sulphide, and ammonia were high as  
compared to unpolluted waters. (EIS-Deal)  
W78-12520

**SAMPLING, PRESERVATION AND STORAGE  
OF WATER SAMPLES FOR ANALYSIS OF  
METALS,**  
Norsk Inst. for Vannforskning, Blindern.  
For primary bibliographic entry see Field 2K.  
W78-12524

**TECHNIQUE FOR REMOVAL OF DISSOLVED  
AND DISPERSED HYDROCARBONS FROM  
BIOASSAY EFFLUENTS,**  
South Carolina Univ., Columbia. Dept. of Geolo-  
gy.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

W. S. Moore, J. L. Hyland, B. D. Melyan, W. Galloway, and P. Rogerson.  
Environmental Science and Technology, Vol 12, No 5, p 595-596, 1978. 1 fig, 1 tab, 4 ref.

Descriptors: \*Oil, \*Oil pollution, \*Bioassay, Organic compounds, Fuels, Analytical techniques, Laboratory tests, Equipment, Filters, \*Filtration, Chemical analysis, Water analysis, Water quality, Methodology, \*Pollutant identification.

A method for the efficient removal of petroleum-derived hydrocarbons from the oil-contaminated effluent of a continuous flow-through oil bioassay system is described. The concentration of No. 2 fuel oil in the effluent, discharged at rates from 17 to 26 L/min, is reduced from an average of 17 approximately 1 ppm by passing the water through acrylic fibers. (EIS-Deal)  
W78-12525

#### AERIAL SURVEILLANCE TO MONITOR WATER QUALITY IN CATFISH PONDS, Mississippi State Univ., Mississippi State. Dept. of Wildlife and Fisheries.

H. R. Robinette, D. Finnie, F. D. Whisler, J. Young, and W. F. Miller.

In: Proceedings of the Twenty-ninth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 12-15, 1975, St. Louis, Missouri, p 287-293, (1975). 2 tab, 5 fig, 7 ref.

Descriptors: \*Water quality, \*Aquaculture, Ponds, \*Fish management, \*Fish farming, \*Monitoring, \*Aerial photography, \*Remote sensing, \*Catfish, \*Farm ponds, Photography, Oxygen, Commercial fish, Suspended solids, \*Infrared photography, \*Munsell color system.

Remotely sensed data and ground truth data were collected simultaneously from 16 experimental ponds during 6 days in June and July, 1974. Color infrared images were taken with hand-held 35 mm cameras from single engine aircraft. Numerical color values for pond color were obtained by visually matching the pond color with a Munsell color system chip which had a standardized numerical value assigned to it. Ground truth data involved the determination of 14 chemical, physical and biological parameters. Regression analysis indicated a significant correlation existed only between total and inorganic solids and the Munsell Color System. There was evidence to suggest that the color-inorganic solid relationship was masked by the organic solids present.  
W78-12526

#### MODEL STATE INFORMATION SYSTEM FOR THE SAFE DRINKING WATER PROGRAM. VOLUME I: SUBSYSTEM DESCRIPTION DEFINITION OF SYSTEM REQUIREMENTS.

American Management Systems, Inc., Arlington, VA.

For primary bibliographic entry see Field 5G.  
W78-12548

#### MODEL STATE INFORMATION SYSTEM FOR THE SAFE DRINKING WATER PROGRAM. VOLUME II: EXHIBITS, DEFINITION OF SYSTEM REQUIREMENTS.

American Management Systems, Inc., Arlington, VA.

For primary bibliographic entry see Field 5G.  
W78-12549

#### MODEL STATE INFORMATION SYSTEM FOR THE SAFE DRINKING WATER PROGRAM. VOLUME III: DATA ELEMENT DICTIONARY DEFINITION OF SYSTEM REQUIREMENTS.

American Management Systems, Inc., Arlington, VA.

For primary bibliographic entry see Field 5G.  
W78-12550

#### MICROBIOLOGICAL CONDITIONS OF THE WATERS AROUND THE AUGUSTA ROAD-STEAD (IN ITALIAN).

Messina (Italy). Ist. di Idrobiologia.  
For primary bibliographic entry see Field 5C.  
W78-12556

#### STUDIES OF TRACE METALS IN THE WATERS AND SEDIMENTS OF BADFISH CREEK AND LAKE WINGRA, NEAR MADISON, WISCONSIN.

Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.

J. J. Delfino, M. A. Degelow, and T. E. Imbrigiotta.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 966, Price codes: A04 in paper copy, A01 in microfiche. Wisconsin Water Resources Center, Madison, Technical Report WIS WRC 78-07, 1978. 44 p, 18 fig, 6 tab, 24 ref. OWRT A-071-WIS(2), 14-34-0001-7105, 14-34-0001-7106.

Descriptors: \*Iron, \*Manganese, \*Zinc, \*Lead, \*Sewage treatment, \*Sewage effluents, Water pollution, \*Sediment particle size, Lake sediments, Wisconsin, Trace elements, Metals, \*Pollutant identification, Waste water treatment, \*Badfish Creek (Wisc), Lake Wingra (Wisc).

The objectives were: to evaluate analytical techniques for measuring selected trace metals in natural waters and, in particular, to develop a mechanism for metals discharged from a sewage treatment plant to a receiving stream; and to determine metal associations in stream and lake sediments, particularly related to distributions among various particle size fractions. Experiments with the Mn(II)-TTA complex indicated that 2-thenoyl-trifluoroacetone (TTA) was not a satisfactory method for directly measuring Mn(II) at the microg/L level in natural waters. Field studies performed in Badfish Creek, south of Madison, WI indicated that the majority of the Creek sediments consisted of sand sized particles. However, as expected, on a per gram basis, the silt and clay fraction contained the highest trace metal concentrations. The concentrations of Pb, Zn, Fe, Mn, Cr and Cu in Badfish Creek sediments generally decreased with distance downstream from a metropolitan sewage treatment plant. In Lake Wingra, adjacent to Madison, WI, storm sewers and tributary creeks are the principal conduits for non-point sources of Pb, Zn, Fe and Mn deposited in the sediments. Lead and Zn are carried as suspended particulates in the silt fractions. The Pb and Zn also appeared to be affected by the presence of Fe and Mn oxides in the sediments, perhaps due to a controlling influence of the former. Organic matter may be affecting trace metal behavior but not clear mechanism was obvious.  
W78-12603

#### INVESTIGATION OF THE CHEMICAL IDENTITY OF SOLUBLE ORGANOPHOSPHORUS COMPOUNDS FOUND IN NATURAL WATERS,

Tennessee Univ., Knoxville. Dept. of Civil Engineering.

R. A. Minear.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 967, Price codes: A07 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, Knoxville, Research Report No. 64, April 1978. 140 p. OWRT A-035-TEN(3), 14-34-0001-7090.

Descriptors: \*Phosphorus compounds, Algal cultures, Soluble organics, Natural waters, Chlorella, \*Organophosphorus compounds, \*Phosphates, Anacystis, \*Pollutant identification, Analytical techniques, \*Dissolved organic phosphorus, Chlamydomonas, \*Sephadex gel filtration, \*Chromatography (Thin-layer), Inositol phosphates, Radiophosphorus, Autoradiography.

Four algal species (*Chlamydomonas reinhardtii*, *Chlorella pyrenoidosa*, *Anacystis nidulans*, and *Anabaena flos-aquae*) were grown in batch culture on 32P labelled media to yield dissolved organic phosphorus (DOP) compounds containing a radioactive tag. The DOP compounds of filtered culture solutions were characterized by Sephadex gel filtration and thin layer chromatography (TLC) as a function of culture age. Additional TLC of individual Sephadex fractions was conducted. Time, culture and known compounds (inositol mono and hexaphosphate) comparisons were made. High performance liquid chromatography was used to separate inositol mono- and hexaphosphates and to compare the DOP of one algal species (*C. reinhardtii*) with inositol phosphates. Combinations of alkaline bromination and Sephadex pretreatment were examined.  
W78-12607

#### CHEMISTRY OF SNOW MELTWATER: CHANGES IN CONCENTRATION DURING MELTING.

Norsk Institutt for Vannforskning, Blindern.

For primary bibliographic entry see Field 2K.  
W78-12630

#### UTILIZATION OF FISH AS INDICATORS OF WATER QUALITY: AND COMPARISON WITH THE BIOTIC INDEX METHOD: APPLICATIONS TO THE LAXIA RIVER IN THE FRENCH BASQUE REGION AND THE GABAS RIVER IN THE LANDES DEPARTMENT, (IN FRENCH).

Station d'Hydrobiologie Continentale, Biarritz (France). Lab. de Methodologie des Inventaires.

M. Laurent, and F. Calvet.

Ann Hydrobiol 8(1), p 67-88, 1977.

Descriptors: Invertebrates, \*Bioindicators, Fish, \*France, \*Laxia River (Fr), \*Gabas River (Fr), Rivers, \*Methodology, \*Water quality indicators.

Study of 2 rivers (physico-chemistry, invertebrates and fish for 1 river, and only fish for the other) showed that the diversity index and the mean condition factor applied to the fish stock give results comparable with those obtained by the physico-chemical study and by the biotic index method to show up the alteration of an aquatic environment. The diversity index method applied to fish for pollution characterization would present 2 advantages to confirm other methods and to be workable by a less highly specialized staff.--Copyright 1978, Biological Abstracts, Inc.  
W78-12634

#### A MULTILEVEL DEVICE FOR GROUND-WATER SAMPLING AND PIEZOMETRIC MONITORING.

Department of the Environment, Ottawa (Ontario). Hydrology Research Div.

For primary bibliographic entry see Field 7B.  
W78-12636

#### DISSOLVED SILICA IN PORE WATERS OF LAKES ONTARIO, ERIE, AND SUPERIOR SEDIMENTS.

Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 2J.  
W78-12645

#### TRACE METALS IN SEA SCALLOPS, PLACOPecten MAGELLANICUS, FROM EASTERN UNITED STATES.

National Marine Fisheries Service, Milford, CT. Milford Lab.

R. A. Greig, D. R. Wenzloff, C. L. MacKenzie, Jr., A. S. Merrill, and U. S. Zdanowicz.

Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 3, p 326-334, 1978. 1 fig, 4 tab, 9 ref.



# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Identification Of Pollutants—Group 5A

**Descriptors:** \*Mollusks, \*Heavy metals, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc, \*Trace elements, Animal metabolism, \*Animal physiology, \*Benthic fauna, Path of pollutants, Metals, Northeast United States, Atlantic Ocean, Tissue analysis, Bioaccumulation, \*Scallops.

Sea scallops were collected from 42 sampling locations off the Northeastern United States coast. Tissue was analyzed for 8 trace metals concentrations. Most metals, except zinc, were below detectable levels in muscle tissue. In contrast to muscle, silver, cadmium, copper and zinc were present in detectable concentrations in gonadal tissue. Concentrations of these metals were generally greater in females. When total visceral mass metal concentration was determined, only mercury and lead were below detection limits. (EIS-Deal) W78-12672

**STREAM QUALITY IN THE SAN LORENZO RIVER BASIN, SANTA CRUZ COUNTY, CALIFORNIA,**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 5B. W78-12734

**THE HYDROLOGY OF LAKE ROUSSEAU, WEST-CENTRAL FLORIDA,**  
Geological Survey, Tallahassee, FL. Water Resources Div.  
For primary bibliographic entry see Field 7C. W78-12741

**CHEMICAL POLLUTANTS IN RELATION TO DISEASES IN FISH,**  
Chicago Medical School, IL. Dept. of Microbiology.  
For primary bibliographic entry see Field 5C. W78-12754

**VARIATION IN TOXICITY TESTS OF BIVALVE MOLLUSC LARVAE AS A FUNCTION OF TERMINATION TECHNIQUE,**  
Washington State Dept. of Fisheries, Brinnon. Shellfish Lab.-Point Whitney.  
R. D. Cardwell, C. E. Woelke, M. I. Carr, and E. Sanborn.  
Bulletin of Environmental Contamination and Toxicology, Vol. 20, p 128-134, 1978. 1 fig, 1 tab, 9 ref.

**Descriptors:** \*Toxicity, \*Analytical techniques, \*Mortality, \*Testing procedures, Embryonic growth stage, Larval growth stage, Larvae, Growth stages, Sampling, Laboratory tests, Testing, Oysters, Clams, Water chemistry, Water analysis, Chemical analysis, Bioassays, Methodology.

This paper addresses two aspects of the bivalve embryo acute toxicity test procedure, namely the potential errors associated with subsampling the veliger-stage larvae at the end of the test and the relative sensitivity and precision of the mortality criterion. It is recommended that the filtration step be eliminated and that toxicant effects on mortality be reported along with those for abnormality. Control responses and their precision of measurement should also be reported along with a notation as to whether treatment responses were corrected for those of the controls. This information, which is not always reported explicitly, is considered essential for assessing the quality of the data. (EIS-Deal) W78-12756

**AUTOMATED POLLUTION MONITORING WITH MICROCOSMS,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.  
J. Cairns, Jr., K. L. Dickson, J. P. Slocumb, S. P. Almeida, and J. K. T. Eu.

International Journal of Environmental Studies, Vol. 10, p 43-49, 1976. 5 fig, 15 ref.

**Descriptors:** \*Ecosystems, \*Monitoring, \*Diatoms, Aquatic environment, Mathematical models, Water analysis, Water quality, Water quality control, Filters, Optical properties, Microorganisms, Chemical analysis, Data collections, Automation, Automatic control, Methodology, Microcosms.

Control measures applied to aquatic ecosystems, in the absence of information on the condition of the system, are apt to be inappropriate and thus may overprotect the receiving system at times and underprotect it at others since the ability of ecosystems to receive wastes is not constant through time or from one ecosystem to another. A major determinant of the effectiveness and efficiency of ecological quality control is the lag time in the feedback of biological information. This microcosm monitoring system is based on the use of a coherent optical spatial filtering system to identify diatoms rapidly. (EIS-Deal) W78-12758

**COMPARISON OF SEMI-CONTINUOUS AND CONTINUOUS FLOW BIOASSAYS,**  
Utah Water Research Lab., Logan.  
J. H. Reynolds, E. J. Middlebrooks, D. B. Porcella, and N. Greeney.  
Progress in Water Technology, Vol. 9, p 897-909, 1977. 7 fig, 2 tab, 13 ref.

**Descriptors:** \*Bioassay, \*Testing procedures, Toxicity, Analytical techniques, Cytological studies, Aquatic algae, Phenols, Water pollution effects, Growth rates, Growth stages, Inhibition, Methodology, \*Selenastrum.

Semi-continuous flow cultures are characterized by varying organism specific growth rate, substrate concentration, and cell concentration. Continuous flow cultures establish a steady state at which organism specific growth rate, substrate concentration, and cell concentration are theoretically constant. A comparison of data obtained from a specific phenol toxicity experiment conducted with both semi-continuous and continuous flow cultures does not appear to be in agreement. Competitive inhibition constants obtained from semi-continuous flow cultures indicate less phenol toxicity to the alga *Selenastrum capricornutum* than inhibitor constants obtained from continuous flow cultures. This difference may be due to the variation in organism specific growth rate typically observed in semi-continuous cultures which may mask certain toxic effects. (EIS-Deal) W78-12759

**APPARATUS TO DETECT TOXIC IONS IN THE ATMOSPHERE OR DISSOLVED IN WATER,**  
Ministere des Armees, Paris (France). Delegation Ministerielle pour l'Armement.  
F. Landon, M. Bonnemay, J. Laverge, P. Malaterre, and J. Royon.  
U.S. Patent No. 4,083,766, 11 p, 8 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 969, No 2, p 630, April 11, 1978.

**Descriptors:** \*Patents, \*Water pollution, \*Air pollution, Ions, Toxicity, Electrolysis, Electrodes, Electrolytes, Electrochemistry, Monitoring, \*Pollutant identification.

A process detects toxic ions in the atmosphere or dissolved in water with an electrochemical cell which comprises an active electrode, a reference electrode and a counter electrode, connected by an electrolyte and to which a voltage is applied. The voltage alternates on each side of the thermodynamic potential. The cell, which is adapted to detect toxic gases in air, comprises a condensation chamber connected to a venturi for the admission of air and electrolyte, and to a measurement chamber. The electrolyte carrying the dissolved

toxic gas is condensed in this chamber prior to passing through the measurement chamber. The invention is applicable in particular to check the atmosphere of workshops, and to check the pollution of bodies of water with an independent portable unit. (Sinha-OEIS) W78-12798

**STUDY OF DETECTION, IDENTIFICATION, AND QUANTIFICATION TECHNIQUES FOR SPILLS OF HAZARDOUS CHEMICALS,**  
Battelle Pacific Northwest Labs., Richland, WA.  
G. A. Sandness, J. F. Washburn, and S. B. Ailes.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 216, Price codes: A09 in paper copy, A01 in microfiche. Coast Guard Office of Research and Development Report No. CG-D-114-76, October 1976. 197 p, 34 fig, 21 tab, 59 ref. DOT-CG-54323-A.

**Descriptors:** \*Pollutant identification, \*Water pollution, Chemicals, Oil pollution, Analytical techniques, Remote sensing, Prototypes, Hazardous materials, Aerial scanner system.

Some of the initial technical data needed by the Coast Guard and the EPA for monitoring water pollution in inland and coastal waters is provided. In the first part of this report twelve generalized remote and insitu water pollution sensing techniques are identified and discussed. The relative potential and current detectability, identifiability, and quantifiability of each of the first 400 chemicals in the Coast Guard's CHRIS list are estimated with respect to each of these techniques. The results are presented as numerical matrices or charts. Needs for further research and development of pollution sensing instrumentation are discussed. The second part of the report describes the design and testing of a prototype, active, aerial scanner system being developed by Battelle-Northwest for nighttime pollution detection. The feasibility of the design concept was demonstrated by laboratory and flight tests of the scanner together with laboratory measurements of the fluorescence spectra of fourteen oils and five other chemicals. (Sinha-OEIS) W78-12821

**MECHANISMS OF HYDROGEN SULFIDE RELEASE FROM COASTAL MARINE SEDIMENTS TO THE ATMOSPHERE,**  
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.  
For primary bibliographic entry see Field 2L. W78-12848

**CONCENTRATIONS OF HEAVY METALS IN SMALL NORWEGIAN LAKES,**  
Norsk Inst. for Vannforskning, Blindern.  
For primary bibliographic entry see Field 5B. W78-12861

**FURTHER STUDIES OF PLANKTON ECOSYSTEMS IN THE EASTERN INDIAN OCEAN IV. NUMERICAL TREATMENT IN SITE-SPECIES DATA,**  
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Mathematics and Statistics.  
S. M. Carpenter.  
Australian Journal of Marine and Freshwater Research, Vol. 28, No. 5, p 585-591, 1977. 1 tab, 11 ref.

**Descriptors:** \*Species composition, \*Analytical techniques, \*Numerical analysis, \*Plankton, \*Indian Ocean, \*Classification, Ecosystems, Sites, Methodology, Equations, Computer programs, Bioindicators, Species diversity, Similarity.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

Various data analysis techniques used in a series of papers on plankton ecosystems of the eastern Indian Ocean are described, together with common terminology and notation. As standard statistical methods were unsatisfactory because of unequal time intervals, missing observations, and heterogeneous data, the methods adopted were based on classification analysis, largely following Lance and Williams (1968). Application of these techniques to marine biology is relatively new. Two methods of numerical classification are discussed, based on presence-absence data and on numerical data. Natural groupings of stations (latitude x time) and of species are thought to exist, and the goal is to: (1) obtain groupings, and (2) explain discontinuities in biotic or abiotic terms. All classifications chosen were hierarchical, and were either divisive or agglomerative. In a monothetic classification, a group divides into subgroups in which one possesses a particular attribute, the others do not. In a polythetic classification two groups are combined on the basis of similarity. Qualitative as well as quantitative data can be used with most methods, but use of presence-absence data will give rare attributes an effect out of proportion to their occurrence. These techniques are described: (1) information analysis, (2) similarity analysis, (3) normal and inverse analyses, (4) two-way matrices, and (5) diagnostic methods. (See also W78-12869) (Lynch-Wisconsin)

W78-12868

**COMPARISON OF LIGHT AND ELECTRON MICROSCOPIC DETERMINATIONS OF THE NUMBER OF BACTERIA AND ALGAE IN LAKE WATER.**  
Lund Univ., (Sweden). Dept. of Microbiology. K. Larsson, C. Weibull, and G. Cronberg. Applied and Environmental Microbiology, Vol. 35, No. 2, p 397-404, February 1978. 3 fig, 2 tab, 27 ref.

Descriptors: \*Microscopy, \*Electron microscopy, \*Bacteria, \*Algae, \*Lakes, \*Instrumentation, \*Laboratory tests, \*Analytical techniques, \*Methodology, \*Microorganisms, \*Acridine stains, \*Research equipment, \*Lake Bysjon (Sweden), Sweden, Abundance, Measurement, Monitoring.

Comparison of counts of bacteria and algae in lake water made by bright-field light microscope and by electron microscope showed good agreement between the methods, though preparations for the latter from some samples contained small vibriolike bodies and ill-defined structures which made precise comparison more difficult. Bacteria and small cyanophytic and chlorophytic algae could not always be differentiated with the light microscope, but was easily accomplished with electron microscopy. Results show that transmission electron microscopy can be used for checking light microscopic microorganism counts in lake water. Use of acridine orange or some other acridine-based stain is best for light microscopic counts. Pure cultures of bacteria and algae included *Proteus mirabilis*, *Pseudomonas fluorescens*, and *Pandorina morum*. Lake water samples were obtained from Lake Bysjon, east of Malmo, Sweden, and from a pond at Lomma, north of Malmo. Light microscope determinations were performed using conventional counting chambers. Tests with the fluorescence microscope were carried out through staining the organisms with acridine orange and filtering them onto Nuclepore filters. For transmission electron microscopy water samples were concentrated by centrifugation; the pellet was then solidified in agar, fixed, dehydrated, embedded in Epon, and thin-sectioned. (Lynch-Wisconsin)

W78-12888

**PROCEEDINGS OF THE 3RD AQUATIC TOXICITY WORKSHOP HELD IN HALIFAX, NOVA SCOTIA, NOVEMBER 2-3, 1976.**  
Environmental Protection Service, Halifax (Nova Scotia).

Environment Canada, Atlantic Region Surveillance Report EPS-5-AR-77-1, 1977. 176 p. Parker, W.R., et al., eds.

Descriptors: \*Pollutant identification, \*Bioassays, \*Toxicity, \*Mortality, \*Methodology, \*Laboratory tests, \*Laboratory equipment, \*Environmental control, \*Reviews, \*Laboratory animals, \*Environment, \*Canada, \*Halifax, \*Nova Scotia, \*Conference.

A workshop was held in Halifax, Nova Scotia, November 2-3, 1976 to exchange technical information on methods and applications of aquatic bioassays. The papers included presentations on both the technical and philosophical aspects of standardization of bioassays. (See also W78-12953 thru W78-12965) (EIS-Katz)

W78-12952

**STANDARDIZATION AND PROTOCOLS OF BIOASSAYS - THEIR ROLE AND SIGNIFICANCE FOR MONITORING, RESEARCH AND REGULATORY USAGE.**  
Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst. J. C. Davis.

In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Tech. Report No. EPS-5-AR-77-1, Halifax, Canada, 1977, p 1-14. 2 tab, 2 fig, 22 ref.

Descriptors: \*Bioassay, \*Methodology, \*Laboratory equipment, \*Laboratory tests, \*Toxicity, \*Mortality, \*Canada, \*Environment, \*Water pollution effects, \*Pulp wastes, \*Pulp and paper industry, \*Fish physiology.

This paper reviews the subject of bioassay procedures, their standardization and the use of protocols in bioassay methodology. Test types are discussed and test selection techniques described. It is stressed that the original objective in doing the test be carefully defined and the most practical test to suit the objective selected. The nature of standardization, techniques for standardization, and the dangers of over-standardization are summarized. Over-standardization can result in inflexibility, stifle innovation and lead to impractical conditions making the tests, in some cases, irrelevant. Priorities for future work are discussed with emphasis on the need for receiving water tests and relevance of test procedures. (See also W78-12952) (EIS-Katz)

W78-12953

**STATISTICAL CONSIDERATIONS IN PLANNING AQUATIC BIOASSAYS.**  
Canada Centre for Inland Waters, Burlington (Ontario). P. V. Hodson, C. W. Ross, A. J. Niimi, and D. J. Spry.

In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Tech. Report No. EPS-5-AR-77-1, Halifax, Canada, 1977, p 15-31. 9 fig, 7 ref.

Descriptors: \*Methodology, \*Bioassay, \*Laboratory tests, \*Statistical methods, \*Statistical modes, \*Mathematical studies, \*Computers, \*Toxicity, \*Probit analysis, \*Computer analysis, \*Experimental design.

Detailed understanding of the assumptions and statistical calculations of probit analysis are limited to a few statisticians. For the practitioner, probit analysis using computer programs is a 'black box' method, i.e., the derivation of the results may not be subjected to question. This paper examines the results of contrived and real toxicity data using a probit analysis program to illustrate how experimental design (e.g. number of concentrations, fish per tank, and replicates) affects fiducial limits, chi-square, slope, and vari-

ance of slope. Recommendations are also made for experimental approaches that would provide a more rational bioassay data base to support legal and environmental requirements. (See also W78-12952) (EIS-Katz)

W78-12954

**BEHAVIORAL ASSAYS - PRINCIPLES, RESULTS AND PROBLEMS.**  
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst. E. Scherer.

In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Tech. Report No. EPS-5-AR-77-1, Halifax, Canada, 1977, p 33-40. 1 fig, 33 ref.

Descriptors: \*Bioassays, \*Water pollution effects, \*Methodology, \*Fish physiology, \*Toxicity, \*Fish behavior, \*Biochemistry, \*Pathology, \*Laboratory tests, \*Behavioral assays, \*Sublethal impairment, \*Locomotor reactions, \*Preference, \*Avoidance, \*Locomotor activity.

Behavior is based on integration of underlying physiological functions (e.g. sensory processes, metabolism, hormonal conditions). Sublethal impairment at any of these physiological sites is likely to show up in the behavioral output. Some behavioral effects, particularly inter- and intra-specific responses, are difficult to demonstrate and quantify under standardized conditions. Certain locomotor reactions controlled by abiotic factors appear more suitable for routine testing. A fish or invertebrate may, in a quantifiable way, respond to a pollutant by approach or withdrawal (preference/avoidance tests), or by change of a given locomotor pattern (e.g. locomotor activity). The present state of using such responses in bioassays is reviewed, considering technical aspects and questions of interpretation. Options and conditions for standardization are presented and discussed. (See also W78-12952) (EIS-Katz)

W78-12955

**CHEMISTRY IN THE DETERMINATION OF TOXICITY OF CHEMICALS TO AQUATIC FAUNA.**  
Fisheries and Marine Service, St. Andrews (New Brunswick). V. Zitko.

In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Tech. Report No. EPS-5-AR-77-1, Halifax, Canada, 1977, p 41-48. 1 fig, 14 ref.

Descriptors: \*Methodology, \*Water chemistry, \*Water quality, \*Bioassay, \*Toxicity, \*Monitoring, \*Water pollution effects, \*Metabolism, \*Chemistry, \*Chemical reactions, \*Aquatic animals.

The chemical characterization of water and tested compounds, monitoring of the concentration of tested compounds in water and animals during the tests, identification of breakdown products and metabolites, and structure-activity relationships are discussed. The importance of close cooperation between biology and chemistry is emphasized. (See also W78-12952) (EIS-Katz)

W78-12956

**THE USE OF AVOIDANCE-PREFERENCE BIOASSAYS WITH AQUATIC INVERTEBRATES.**  
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.

H. D. Maciorowski, R. M. Clarke, and E. Scherer. In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Technical Report No. EPS-5-AR-77-1, Halifax, Canada, 1977, p 49-58. 2 tab, 4 fig, 28 ref.

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Descriptors: \*Toxicity, Bioassay, \*Laboratory tests, Methodology, Invertebrates, Laboratory animals, Laboratory equipment, \*Behavior, Metals, Oil, Chlorinated hydrocarbon pesticides, Animal physiology, \*Copper, Avoidance, Preference.

The potential exposure of aquatic organisms to lethal and sublethal concentrations of toxicants can be assessed by their behavior in avoidance-preference bioassays. Several avoidance-preference systems have been tested or modified for use with invertebrates. Invertebrate avoidance-preference responses have been monitored for various heavy metals, pesticides, and oil. Not all invertebrates are equally suitable for these avoidance-preference tests. Test conditions should be chosen to fit the general biology of the species. The behavioral response may vary with the physiological state of organism. Although avoidance or preference responses can be detected in avoidance-preference bioassays, the physiological and biochemical mechanisms causing these responses usually are unknown. In agreement with results reported for fish, the direct behavioral response of invertebrates to toxicants is no indication of toxicity. This is illustrated by the avoidance by *Gammarus lacustris* of 0.15 and 0.46 mg/l Cu++ and its attraction to 12.3 and 30.0 mg/l Cu++. The experimental design of avoidance-preference bioassays may be modified to measure the effects of toxicants on other behavioral patterns such as reactions to food stimuli. (See also W78-12952) (EIS-Katz) W78-12957

#### A DISCUSSION ON THE USE OF BEHAVIOR BY GAMMARUS PSEUDOLIMNAEUS BOUSFIELD IN EVALUATING ENVIRONMENTAL STRESS.

Fisheries and Marine Service, Halifax (Nova Scotia).  
R. R. Wallace.  
In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Technical Report No. EPS-5-AR-77-1, Halifax, Canada, 1977, p 59-67. 1 tab, 8 fig, 8 ref.

Descriptors: \*Stress, \*Methodology, \*Toxicity, \*Bioassays, Laboratory tests, Laboratory animals, Invertebrates, \*Amphipoda, Animal physiology, Animal behavior, Environment, Light intensity, Water temperature, Seasonal, Ultraviolet radiation.

An apparatus was constructed to automatically monitor the activity of *G. pseudolimnaeus* in the laboratory. Variables such as current speed, light, food and pollutants were introduced into carefully controlled situations and the change of behavioral activity was noted. Although *G. pseudolimnaeus* has been studied extensively in the field, our results indicate that a considerable amount of new data may be acquired by an experimental, laboratory approach to behavioral studies of aquatic invertebrates. (See also W78-12952) (EIS-Katz) W78-12958

#### A FIELD TECHNIQUE FOR STUDYING THE AVOIDANCE OF FISH TO POLLUTANTS.

Fisheries and Marine Service, Vancouver (British Columbia). Habitat Protection Directorate.  
I. K. Birtwell.  
In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Tech. Report No. EPS-5-AR-77-1, Halifax, Canada, 1977, p 69-86. 4 tab, 5 fig, 34 ref.

Descriptors: \*Toxicity, Bioassay, Mortality, Marine fish, Juvenile fish, \*Chinook salmon, Herring, On-site investigations, Mortality, \*Pulp wastes, Pulp and paper industry, Behavior, Water, \*Pollution effects, Estuarine environment, Water quality, Industrial wastes, Chum salmon, Clupea, \*Avoidance reactions.

An experimental field technique is described which may be used to study the behavior of fish and shallow, stratified waters. The technique is particularly suited to determining the avoidance or preference, by fish, of water quality changes in both polluted and unpolluted situations. The technique was used to determine the effects of pulp mill effluents on the vertical distribution of juvenile salmon (*Oncorhynchus keta* and *O. tshawytscha*) and juvenile herring (*Clupea harengus pallasii*) in a brackish water environment. Although there was a differential response, all species of fish reacted to changes in the receiving water quality which were associated with the discharge of pulp mill effluent. Avoidance effects increased with proximity to the outfalls from the pulp mill. (See also W78-12952) (EIS-Katz) W78-12959

#### ASSESSMENT OF THE TOXICITY OF LANDFILL LEACHATES BY THE RESIDUAL OXYGEN BIOASSAY.

EVS Consultants Ltd., New Westminster (British Columbia).  
G. A. Vigers, and B. M. Ellis.

In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Halifax, Canada, Technical Report No. EPS-5-AR-77-1, 1977, p 87-106. 8 tab, 5 fig, 16 ref.

Descriptors: On-site investigations, \*Mortality, \*Bioassay, \*Toxicity, Rainbow trout, Dissolved oxygen, \*Landfills, Statistical methods, Statistics, Water temperature, Hydrogen ion concentration, Laboratory equipment, Residual oxygen bioassay, LC50, Threshold values, \*Landfill leachates.

The Residual Oxygen Bioassay is a rapid bioassay procedure which for rainbow trout (*Salmo gairdneri*) is sensitive to toxic materials at concentrations in the 96-h LC50 range. A simple method of graphing Residual Oxygen Bioassay results is described to determine threshold values. The procedure was evaluated using sodium pentachlorophenate and landfill leachates. The threshold values obtained from the rapid procedure were directly comparable to static 96-hr LC50 bioassays obtained by standard methods. Regression analysis of Residual Oxygen Bioassay data obtained in the field demonstrated a correlation with duplicate samples subjected to static 96-h LC50 bioassays in the laboratory. Further, there was no significant difference in the response of residual oxygen bioassays controls conducted in the lab and in the field. The mobile support facility used for the field studies is also described. (See also W78-12952) (EIS-Katz) W78-12960

#### WATCH THE Y IN BIOASSAY.

Guelph Univ. (Ontario). Dept. of Zoology.  
J. B. Sprague, and A. Fogels.

In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Halifax, Canada, Tech. Report No. EPS-5-AR-77-1, 1977, p 107-118.

Descriptors: \*Methodology, \*Laboratory tests, Laboratory equipment, \*Statistical methods, Statistical analysis, Laboratory animals, Analysis, Water pollution effects, Mortality, Standards, Rainbow trout, Standard tests, Fiducial tests, Canadian bioassays.

We need to pay more attention to why we are following certain practices in interpreting bioassays. First of all we should ask ourselves why we are doing a bioassay, and then match the procedure to the purpose. This leads to a multiplicity of methods, not to one standard test. A recent tabulation of purposes has been made by an FAO committee and is reviewed. Secondly we should ask why we usually calculate and state fiducial limits of LC50's. They are meant to be used but seldom are. A technique is suggested for telling whether

one response is significantly different from another. Thirdly, we should ask why we are standardizing on rainbow trout. Reasons are given for using a small tropical fish for Canadian bioassays. (See also W78-12952) (EIS-Katz) W78-12961

#### AN EVALUATION OF DEATH BY HYPOXIA IN A MARINE FISH AS AN INDICATOR OF OIL DEPRESSANT TOXICITY.

Fisheries and Marine Service, St. John's (Newfoundland).  
J. W. Kiceniuk, and J. F. Payne.  
In: Proceedings of the 3rd Aquatic Toxicity Workshop, Nov. 2-3, 1976, Halifax, Nova Scotia, Environment Canada, Tech. Report No. EPS-5-AR-77-1, Halifax, Canada, p 119-122. 1 fig, 7 ref.

Descriptors: Methodology, \*Toxicity, \*Bioassay, Mortality, Marine fish, Oil, Oil spills, Oxygen, Water pollution effects, Fish physiology, Laboratory tests, Laboratory equipment, Dissolved oxygen, \*Detergents, \*Hypoxia, \*Commercial oil spills, Dispersants.

There may be a correlation between the toxicity of a substance and oxygen tension after death by hypoxia. We have investigated this hypothesis using a series of commercial oil spill dispersants. Most dispersants even at concentrations of 2000-2500 ppm did not change the oxygen tension at death of a pelagic marine fish, *Mallotus villosus*. There appeared to be a trend towards higher residual oxygen tensions with alkylphenol polyethoxylate type detergents (known to be highly toxic). This trend is evident at much higher concentrations (-30 times) than the bradycardia threshold for this species. Oxygen tension after death by hypoxia may not be reliable sensitive indicator for general use in toxicity studies. Possible sites of action of nonionic detergents are discussed. (See also W78-12952) (EIS-Katz) W78-12962

#### CHANGES IN STEROID HORMONE METABOLISM AS A SENSITIVE METHOD OF MONITORING POLLUTANTS AND CONTAMINANTS.

Fisheries and Marine Service, Halifax (Nova Scotia). Halifax Lab.  
H. C. Freeman, and G. Sangalang.

In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Halifax, Canada, Tech. Report No. EPS-5-AR-77-1, 1977, p 123-132. 5 fig, 13 ref.

Descriptors: \*Methodology, \*Bioassay, \*Fish physiology, Animal pathology, \*Animal physiology, Brook trout, Mammals, Laboratory tests, Laboratory equipment, Water pollution effects, Path of pollutants, Cadmium, Metals, Arochloric, Polychlorinated biphenyls, Sublethal effects, \*Steroidogenesis, X-ray autoradiogram, Methylmercury, Gray seal, Selenium, Steroid hormone metabolism.

Fish, known to be sensitive to sublethal levels of pollutants, are used as sensitive indicators to determine the presence of these compounds in water. Method are given to determine the effects of trace quantities of contaminants or pollutants on steroidogenesis. Examples and data are given of altered steroid hormones metabolism in brook trout and also a marine animal, the seal. (See also W78-12952) (EIS-Katz) W78-12963

#### APPLICATION OF TISSUE CULTURE SYSTEMS TO EVALUATE AQUATIC TOXICANTS.

Fisheries and Marine Service, Halifax (Nova Scotia). Halifax Lab.  
M. F. Li, and S. Clyburne.



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, No. 2-3, 1976, Environment Canada, Halifax, Canada, Tech. Report No. EPS-5-AR-77-1, 1977, p 133-140. 6 fig, 19 ref.

Descriptors: \*Metals, \*Cadmium, \*Methodology, Water pollution effects, Bioassay, Laboratory tests, Animal physiology, Animal biochemistry, Enzymes, Growth, Path of pollutants, Animal pathology, \*Tissue culture, Cells, Cellular multiplication, Mitosis, DNA, Metabolism, Nucleoprotein synthesis.

Tissue Culture cells can be readily propagated under standardized conditions without elaborate facilities and provide a bioassay system, completely avoiding the individual variation inherent in intact animals because of age, sex, reproductive condition, previous environment, and other effects that occur through the life cycle of the individual animal. Various parameters of cultivated cells, such as cellular multiplication, respiration, and morphology are discussed. Cadmium chloride at a concentration of 0.5 mg/l significantly affected the cellular multiplication. Morphological studies of the experimental cells revealed that CdCl<sub>2</sub> severely affected normal mitosis. The abnormality of DNA metabolism could affect the nucleoprotein synthesis and consequently result in a poor stainability of the CdCl<sub>2</sub> treated cells by May Grunwald stain. (See also W78-12951) (EIS-Katz)

W78-12964

**COMPARISON OF RAPID BIOASSAY PROCEDURES FOR MEASURING TOXIC EFFECTS OF BLEACHED KRAFT MILL EFFLUENT TO FISH,**  
British Columbia Research Council, Vancouver, Div. of Applied Biology.  
D. J. McLeay, and T. E. Howard.

In: Proceedings of the 3rd Aquatic Toxicity Workshop, Halifax, Nova Scotia, Nov. 2-3, 1976, Environment Canada, Halifax, Canada, Tech. Report No. EPS-5-AR-77-1, 1977, p 141-155. 1 tab, 7 fig, 15 ref.

Descriptors: Methodology, \*Bioassay, Mortality, Laboratory tests, Laboratory equipment, Salmon, Water pollution effects, Path of pollutants, \*Pulp wastes, \*Pulp and paper industry, Fish physiology, Animal biochemistry, Animal pathology, \*Bleached kraft pulpmill effluent, \*Coho salmon, British Columbia.

Comparisons were made between seven sublethal bioassay procedures that have been developed in part as alternatives to the conventional 96-h LC<sub>50</sub> bioassay for measuring the acute toxicity of bleached kraft pulpmill effluent (BKME). The fish tested were juvenile coho salmon (*Oncorhynchus kisutch*); weight 0.82 + or - 0.15 g, length 4.25 + or - 0.21 cm. The study was carried out within seven days using a single 3400-l sample of BKME collected from a British Columbia coastal mill during normal operations. The initial 96-h LC<sub>50</sub> value of 15.0% v/v for the neutralized filtered effluent remained essentially unchanged at 15.8% v/v by the end of the study. Concentration of BKME used in the sublethal bioassays were expressed as proportions of the initial 96-h LC<sub>50</sub> value. (See also W78-12952) (EIS-Katz)

W78-12965

**THE IMPORTANCE OF SEQUENTIAL ASSESSMENT IN TEST PROGRAMS FOR ESTIMATING HAZARD TO AQUATIC LIFE,**  
Proctor and Gamble Co., Cincinnati, OH. Ivorydale Technical Center.

In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, Eds., American Society for Testing and Materials, p 17-35, 1977. 3 fig, 2 tab, 17 ref.

Descriptors: \*Toxicity, \*Chemical properties, \*Testing procedures, Water pollution effects, Testing, Analytical techniques, Aquatic life, Chemical analysis, Environmental effects, Ecology, Life history studies, Bioassay, Path of pollutants, Hazards, \*Toxicity testing.

The qualification process for a new chemical should include not only appropriate toxicity testing but supportive evaluations which allow an assessment of potential risk to aquatic life. Since materials differ not only in toxicological effect but also in other properties that can affect their ecological impact, each material should be considered individually, and any tendency to apply a rigid standard test program to all should be resisted. Guidelines are provided to develop testing programs which will provide a sound basis for hazard assessment without squandering limited scientific resources. Review and assessment of data on a sequential basis are necessary to focus effort on the most appropriate kinds of tests. Based on expected usage and disposal patterns, it is important to estimate the maximum concentrations that are likely to occur in the environment and their critical locations. When chemical or biological tests have indicated that a material will not be persistent, the use of shorter term toxicity tests on sensitive life stages may be substituted for total life-cycle tests. Similarly, consideration of chemical and physical properties may provide guidance on the need or priority for bioconcentration testing. (See also W78-06608) (EIS-Deal)

W78-12966

**PRESENT APPROACHES TO TOXICITY TESTING - A PERSPECTIVE,**  
Environmental Research Lab.-Duluth, MN.  
D. I. Mount.

In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, Eds., American Society for Testing and Materials, p 5-14, 1977. 13 fig.

Descriptors: \*Pollutant identification, \*Bioassay, \*Toxicity, \*Testing procedures, Analytical techniques, Testing, Monitoring, Laboratory tests, Sampling, Measurement, Aquatic environment, Chemical analysis, Life history studies, \*Toxicity testing.

This article serves as an introduction to a series of papers concerning aquatic toxicity. Current trends in the field are reviewed and the use of chronic tests over short-term toxicity tests is advocated. (See also W78-06608) (EIS-Deal)

W78-12967

**AN INDUSTRIAL APPROACH TO EVALUATING ENVIRONMENTAL SAFETY OF NEW PRODUCTS,**  
Monsanto Industrial Chemicals Co., St. Louis, MO.

R. A. Kimerle, G. J. Levinskas, J. S. Metcalf, and L. G. Sharpf.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, Eds., American Society for Testing and Materials, p 36-43, 1977. 3 fig.

A systematic approach is presented for evaluating the safety of new products to employees, customers, and consumers, and the environment. Upon initiation of a project to commercialize a new product, a safety assessment schedule is prepared which considers physical and chemical properties, use patterns, environmental persistence, physical and biological accumulation potential, interaction with environmental components, and toxicity. Safety data are obtained in a logical scheme from simple screening to confirmative studies, thus enabling hazard evaluations to be made continuously during product development. Application and utility of this concept to assess aquatic safety is demonstrated using results from a current detergent builder program. (See also W78-06608) (EIS-Deal)

W78-12968

**A NEW CAPACITOR FLUID - A CASE STUDY IN PRODUCT STEWARDSHIP,**  
Dow Chemical Co., Midland, MI.  
D. R. Branson.

In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, Eds., American Society for Testing and Materials, p 44-61, 1977. 2 fig, 8 tab, 31 ref.

Descriptors: \*Toxicity, \*Testing procedures, \*Chemical properties, \*Capacitors, Hazards, Testing, Laboratory tests, Persistence, Analytical techniques, Monitoring, Polychlorinated biphenyls, Biodegradation, Chemical analysis, Water pollution effects, Environmental effects, Path of pollutants, Aquatic environment, Chemical industry, \*Toxicity testing.

Product stewardship is a commitment to exercising responsible care during the manufacturing, use, and ultimate disposal of chemical products. An important part of product stewardship is the generation of an adequate data base to assess the potential hazards of a new product. A new capacitor fluid is a working example of product stewardship. Electrically, the fluid has been found to perform as well as or better than capacitor-grade polychlorinated biphenyl (PCB) in capacitors. Assessment of its health and environmental acceptability was based on the composite interpretation of movement, stability, bioconcentration, and toxicity data. The use pattern, sediment binding, and recommended disposal suggest that only small amounts of the new capacitor fluid will enter the aquatic environment. The routes for leaving the aquatic environment-biodegradation and volatilization-allow only very low concentrations of the capacitor fluid to remain in water. The bioconcentration potential of the fluid is low enough so that residue levels in fish are not critical to the health of the fish or animal consumers, and its toxicity to aquatic organisms is similar to that of a large group of commodity chemicals and less than PCB's. (See also W78-06608) (EIS-Deal)

W78-12969

**METHODS FOR CALCULATING AN LC<sub>50</sub>,**  
Environmental Research Lab.-Duluth, MN.  
C. E. Stephan.

In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, Eds., American Society for Testing and Materials, p 65-84, 1977. 4 tab, 49 ref.

Descriptors: \*Mortality, \*Toxicity, \*Bioassay, \*Testing procedures, Testing, Analytical techniques, Monitoring, Statistical methods, Laboratory tests, Environmental effects, Water pollution effects, Water analysis, Aquatic environment, \*Toxicity testing, \*LC<sub>50</sub>.

A variety of graphical and computational methods can be used to derive a median lethal concentration (LC<sub>50</sub>) from concentration-mortality data produced by an acute mortality test. In the selection of a method, practical considerations should receive as much attention as the usual theoretical and statistical considerations. No method should be used that does not calculate both LC<sub>50</sub> and its 95 percent confidence limits. Unfortunately, several computational methods will not calculate an LC<sub>50</sub> from some concentration-mortality data that are practically and statistically useful to aquatic toxicologists. Useful, statistically sound information about the LC<sub>50</sub> and its 95 percent confidence limits can be calculated from the data produced by any acute mortality test that meets published criteria of acceptability, by using an internally consistent scheme based on the moving average method and the binomial test. (See also W78-06608) (EIS-Deal)

W78-12970

# A MECHANICAL TOXICANT INJECTOR FOR FLOW-THROUGH TOXICITY TESTS,

Lakehead Univ., Thunder Bay (Ontario). Dept. of Biology.  
G. W. Ozburn, and A. D. Smith.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 85-89, 1977. 2 fig, 1 ref.

Descriptors: \*Equipment, \*Toxicity, \*Testing procedures, Laboratory equipment, Bioassay, Testing, Analytical techniques, Water analysis, Chemical analysis, Laboratory tests, Aquatic environment.

An injector is described for delivering a series of constant concentrations of toxicant in a flow-through toxicity test. The apparatus can be employed either as a single channel unit for use with a proportional diluter or as a multichannel injector for use with an equal-volume water delivery system. The multichannel approach is emphasized for pesticide addition because the test concentrations are independent of each other. This allows the establishment of an unlimited range of toxicant concentrations. Although the system is suitable for toxicity tests employing freshwater diluent, the metal components of the injector may be susceptible to corrosion under saltwater conditions. (See also W78-06608) (EIS-Deal)  
W78-12971

# A FLOW-THROUGH SYSTEM FOR STUDYING INTERACTION OF TWO TOXICANTS ON AQUATIC ORGANISMS,

Georgia Univ., Athens. School of Forest Resources.  
A. G. Auwarter.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 90-98, 1977. 2 fig, 2 tab, 8 ref.

Descriptors: \*Testing procedures, \*Laboratory equipment, \*Toxicity, Bioassay, Testing, Equipment, Analytical techniques, Water analysis, Chemical analysis, Chemical reactions, Chemical properties, Aquatic life, Methodology, \*Toxicity testing.

An intermittent-flow, proportional diluter system has been designed for the study of synergistic and antagonistic effects of two toxicants on aquatic organisms. The system consists of two diluters mounted side by side, each of which produces three toxicant concentrations plus a solvent control. Below the diluters are two additional mixing, sample-splitting levels. The first divides each concentration of each toxicant into four volumes. The second consists of 16 compartments, each of which receives a measured volume from 1 of the 4 concentrations of each toxicant. This produces a 4 by 4 matrix of all 16 possible combinations. This final level also serves as a series of sample-replicating chambers from which the toxicant mixtures flow to 32 test aquaria. (See also W78-06608) (EIS-Deal)  
W78-12972

# METHOD FOR ASSESSING ADDITIVE TOXICITY OF CHEMICAL MIXTURES,

Fish and Wildlife Service, LaCrosse, WI. Fish Control Lab.  
L. L. Marking.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 99-108, 1977. 1 fig, 3 tab, 35 ref.

Descriptors: \*Testing procedures, \*Chemical reactions, \*Toxicity, Rainbow trout, Pesticides, Pesticides, Water analysis, Chemical properties, Chemical analysis, Testing, Analytical techniques, Statistical methods, \*Copper, \*Zinc, \*Nickel, \*Pesticides, \*Insecticides, \*Toxicity testing, \*Malathion, Additive toxicology.

Mixtures of chemicals or pesticides may produce unexpected effects; some are hazardous and some are beneficial. A method was divided in which individual toxic contributions of chemicals are summed, and the additive toxicity is defined by an index for two or more chemicals in combination. This linear index expresses the toxicity quantitatively: zero indicates simple additive toxicity, negative values indicate less than additive toxicity, and positive values indicate greater than additive toxicity. The significance of index values near zero is assessed by substituting values from the 95 percent confidence intervals into the formula to determine whether the range for the additive indices overlaps zero (simple additive toxicity). The range is derived by selecting values of the 95 percent confidence interval yielding the greatest deviation from the additive index. (See also W78-06608) (EIS-Deal)  
W78-12973

# MYSIDOPSIS BAHIA: AN ESTUARINE SPECIES SUITABLE FOR LIFE-CYCLE TOXICITY TESTS TO DETERMINE THE EFFECTS OF A POLLUTANT,

Environmental Research Lab., Gulf Breeze, FL.  
D. R. Nimmo.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 109-116, 1977. 3 tab, 18 ref.

Descriptors: \*Toxicity, \*Cadmium, \*Chemical analysis, Water analysis, Chemical properties, Life history studies, Bioassay, Path of pollutants, Water pollution effects, Environmental effects, Metals, Pesticides, Reproduction, Fecundity, Growth rates, Growth stages, \*Toxicity testing, \*Mysid, \*Mysidopsis.

This study documents the successful use of a mysid for life-cycle toxicity tests. These tests were conducted to determine acute and chronic toxicities of metal (cadmium) and pesticide (Kepone). Delay in the formation of mysid brood pouches and release of young were noted in low concentrations, less than 6.4 microg cadmium/liter. Fewer young produced per female and decreased growth were other indicators of effects of Kepone. (See also W78-06608) (EIS-Deal)  
W78-12974

# SUITABILITY OF SHEEPHEAD MINNOWS (CYPRINODON VARIEGATUS) FOR LIFE-CYCLE TOXICITY TESTS,

Environmental Research Lab., Gulf Breeze, FL.  
D. J. Hansen, and P. R. Parrish.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 117-126, 1977. 7 tab, 19 ref.

Descriptors: \*Life history studies, \*Toxicity, \*Minnows, Bioassay, Fish physiology, Testing procedures, Testing, Estuarine environment, Endrin, pesticides, Heptachlor, Pesticide toxicity, Chemical analysis, Chemical properties, \*Toxicity tests, \*Malathion, \*Carbofuran, \*Methoxychlor.

Entire life-cycle toxicity tests are practical with sheephead minnows. This is the only estuarine fish that has been utilized successfully in life-cycle toxicity tests, using methods formulated only since 1973. Salinity, temperature, and spawning requirements were determined, and initial life-cycle toxicity tests with endrin were conducted at the U.S. Environmental Agency Gulf Breeze (Florida) Laboratory. Subsequent tests with heptachlor, carbofuran, methoxychlor, and malathion were conducted. All studies confirmed the feasibility of using this estuarine fish for determining maximum acceptable toxicant concentrations and application factors. Results of our tests also corroborate data on application factors obtained in studies completed elsewhere with freshwater fishes and the same pesticides. (See also W78-06608) (EIS-Deal)

W78-12975

# BIOASSAYS WITH A NATURAL ASSEMBLAGE OF BENTHIC MACROINVERTEBRATES,

Oklahoma State Univ., Stillwater. School of Biological Sciences.  
S. L. Burks, and J. L. Wilhm.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J. L. Hamelink, eds., American Society for Testing and Materials, p 127-136, 1977. 4 tab, 10 ref.

Descriptors: \*Bioassay, \*Benthic fauna, \*Toxicity, Biological communities, Industrial wastes, Waste water (Pollution), Water pollution effects, Environmental effects, Aquatic environment, Sampling, Oil, Oil pollution, Organic compounds, \*Toxicity testing, \*Diversity.

A new bioassay method for determining the effects of environmental contaminants on populations of benthic macroinvertebrates is described. Colonized Hester-Dandy samplers were transported from a natural stream to artificial streams and exposed to industrial wastewater. Species diversity, number of taxa, and density of the aquatic organisms were measured before and after time intervals of exposure. A 30 and a 32-day continuous-flow exposure test with the benthic macroinvertebrates showed that activated sludge treated petroleum refinery wastewater caused a greater decrease in species diversity than the sequential activated sludge-dual media-activated carbon treated effluent. The effect upon number of taxa and mean density of individuals was even greater. (See also W78-06608) (EIS-Deal)  
W78-12976

# UTILITY OF TOXICITY TESTS WITH EMBRYOS AND FRY OF FISH IN EVALUATING HAZARDS ASSOCIATED WITH THE CHRONIC TOXICITY OF CHEMICALS TO FISHES,

EG and G, Bionomics, Warcham, MA.  
K. J. Macek, and B. H. Sleight, III.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 137-146, 1977. 4 tab, 28 ref.

Descriptors: \*Toxicity, \*Testing procedures, Embryonic growth stage, Fry, Growth stages, Life cycles, Life history studies, Fish physiology, Chemical properties, Chemical analysis, Hazards, Bioassay, Water pollution effects, Metals, Pesticides, Linear alkylate sulfonates, Methodology, \*Toxicity testing.

The hypothesis that concentrations of toxicants safe to fish over their entire life cycle can be estimated from the results of continuous exposure of embryos and newly hatched fry has been examined critically in the light of recent data. The assumptions underlying the proposed hypothesis appear to be: (1) the chemical does not exhibit significant cumulative toxicity; (2) there is a single mode of action through which the effect of the chemical is manifested in a relatively short time frame; and (3) the effect is most severe on the critical life stages (that is, embryos and newly hatched fry), where parameters such as hatchability, survival, and growth can be measured, readily. The majority of available data indicate that the hypothesis is valid. In most cases, estimates of specific application factors derived from exposure of critical life stages reasonably approximate specific application factors empirically derived from chronic toxicity studies with much less cost, effort, time required. (See also W78-06608) (EIS-Deal)  
W78-12977

# CURRENT BIOCONCENTRATION TEST METHODS AND THEORY,

Lilly Research Labs., Greenfield, IN.  
J. L. Hamelink.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

In: Aquatic Toxicology and Hazard Evaluation, F.L. Mayer, J.L. Hamelink, ASTM STP 634, American Society for Testing and Materials, p 149-161, 1977. 2 fig, 30 ref.

Descriptors: \*Toxicity, \*Testing procedure, Bioassay, Chemical properties, Analytical techniques, Laboratory tests, Testing, Chemical analysis, Hazards, Fish physiology, Growth rates, Animal growth, Kinetics, Mathematical models, Aquatic animals, Absorption, \*Toxicity testing, \*Bioconcentration, \*Bioaccumulation, \*Depuration.

Practical and theoretical solutions to the quantitation of chemical accumulation by aquatic animals are evaluated. Laboratory studies presently rely on continuous exposure for extended periods of time to simulate field conditions. Application of the principles of pharmacokinetics permit laboratory results to be compared and indicate that mathematical models can be derived to predict contaminant accumulation under natural conditions adequately. Additional laboratory studies with large-sized and growing fish are identified as future research needs. (See also W78-06608) (EIS-Deal)

W78-12978

#### UPTAKE, CLEARANCE, AND BIOCONCENTRATION OF 14C-SEC-BUTYL-4-CHLORODIPHENYL OXIDE IN RAINBOW TROUT,

Dow Chemical Co., Midland, MI.

F. A. Blanchard, I. T. Takahashi, H. C. Alexander, and H. E. Bartlett.

In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 162-177, 1977. 4 fig, 4 tab.

Descriptors: \*Absorption, \*Fish physiology, \*Rainbow trout, Organic compounds, Animal metabolism, Radioisotopes, Radioactivity techniques, Toxicity, Water analysis, Chemical analysis, Chemical properties, Capacitors, Kinetics, \*Bioconcentration, \*Tissue analysis, \*Depuration.

Steady state bioconcentration factors for sec-butyl-4-chlorodiphenyl oxide in rainbow trout muscle were calculated using a simple two-compartment model for radioassay data of concentrations of 14C in fish and water during an uptake and clearance (depuration) experiment. There was a relatively rapid removal with one half of the material cleared in 30 to 40 h. A partition coefficient (octanol/water) for sec-butyl-4-chlorodiphenyl oxide of 16000 + or - 4900 was measured. The regression equation relating the partition coefficient to bioconcentration factor in trout muscle predicts a bioconcentration factor of 100 to 500, in agreement with the calculated values of 292 and 336. (See also W78-06608) (EIS-Deal)

W78-12979

#### A MODEL SYSTEM TO STUDY THE DESORPTION AND BIOLOGICAL AVAILABILITY OF PCB IN HYDROSOILS,

Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.

For primary bibliographic entry see Field 5B.

W78-12980

#### EVALUATION OF THE SIGNIFICANCE OF WATERWAY SEDIMENT-ASSOCIATED CONTAMINANTS ON WATER QUALITY AT THE DREDGED MATERIAL DISPOSAL SITE,

Texas Univ. at Dallas, Richardson.

G. F. Lee, and G. M. Mariani.

In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F. L. Mayer, and J. L. Hamelink, eds., American Society for Testing and Materials, p 196-213, 1977. 4 tab, 14 ref.

Descriptors: \*Dredging, \*Sediments, \*Manganese, \*Ammonia, Polychlorinated biphenyls, Heavy metals, Chlorinated hydrocarbon pesticides, Nutrients, Bioassays, Toxicity, Aquatic life, Water pollution effects, Water analysis, Chemical properties, Path of pollutants, Water quality.

During the past few years, considerable interest has developed concerning the significance of chemical contaminants associated with dredged sediments. Research has been done on the factors influencing the release of contaminants from waterway sediments and the toxicity of these sediments to various forms of aquatic life. This study has shown that the only two compounds which are released in potentially significant amounts to affect water quality at the disposal site are manganese and ammonia. The other compounds studied including heavy metals, chlorinated hydrocarbon pesticides, polychlorinated biphenyls (PCBs), and aquatic plant nutrients are either not released, released in insignificant amounts, or taken up as a result of mixing the sediments with the overlying waters under conditions which simulate typical dredging and dredged material disposal. Bioassays conducted of the elutriates of the sediments with the sediments present show that, in general, large concentrations of contaminants can be present in dredged sediments which would have little or no effect on water quality at an in-water disposal site. (See also W78-06608) (EIS-Deal)

W78-12981

#### APPLICATION OF AN EVAPORATIVE LOSS MODEL TO ESTIMATE THE PERSISTENCE OF CONTAMINANTS IN LENTIC ENVIRONMENTS,

Purdue Univ., LaFayette, IN. Dept. of Forestry and Natural Resources.

For primary bibliographic entry see Field 5B.

W78-12982

#### AN EVALUATION OF FENITROTHION TOXICITY IN FOUR LIFE STAGES OF RAINBOW TROUT, SALMO GAIARDNERI,

Fisheries and Marine Service, Winnipeg (Manitoba).

For primary bibliographic entry see Field 5C.

W78-12983

#### ACUTE TOXICITY TO AND BIOCONCENTRATION OF ENDOSULFAN BY ESTUARINE ANIMALS,

Environmental Research Lab., Gulf Breeze, FL.

For primary bibliographic entry see Field 5C.

W78-12984

#### THE EFFECT OF SUBACUTE PARATHION EXPOSURE ON THE LOCOMOTOR BEHAVIOR OF THE BLUEGILL SUNFISH AND LARGEMOUTH BASS,

Raytheon Co., Portsmouth, RI. Oceanographic and Environmental Dept.

For primary bibliographic entry see Field 5C.

W78-12985

#### DIET QUALITY IN FISH TOXICOLOGY: EFFECTS ON ACUTE AND CHRONIC TOXICITY,

Fish and Wildlife Service, Columbia, MO. Fish-Pesticide Research Lab.

For primary bibliographic entry see Field 5C.

W78-12986

#### SPONTANEOUS SKELETAL DEFORMITIES IN THE ZEBRA DANIO (BRACHYDANIO RERIO) BRED FOR FISH TOXICITY TESTS,

Unilever Research Colworth/Welwyn Lab., Bedford (England). Environmental Safety Div.

R. D. Piron.

Journal of Fish Biology, Vol. 13, p 79-83, 1978. 1 tab, 1 plate, 12 ref.

Descriptors: \*Fish reproduction, \*Fish genetics, \*Breeding, Bioassay, Testing, Testing procedures, Laboratory tests, Fish diseases, Animal pathology, Aquaria, Genetics, Toxicity, Laboratory animals, Methodology, \*Zebra danio, \*Toxicity testing.

Zebra Danio tropical fish are easily maintained and bred under laboratory conditions; procedures for maintenance and breeding are described. Intensive inbreeding of the fish gave rise to a high incidence of spontaneous skeletal deformities which appear to reflect a genetic defect rather than an environmental stimulus. This finding casts doubt on the suitability of the Zebra Danio for fish toxicity testing. (EIS-Deal)

W78-12993

#### BREEDING THE CONVICT CICHLID (CICHLASOMA NIGROFASCIATUM) FOR USE IN LABORATORY FISH TOXICITY TESTS,

Unilever Research Colworth/Welwyn Lab., Bedford (England). Environmental Safety Div.

R. D. Piron.

Journal of Fish Biology, Vol. 13, p 119-122, 1978. 1 tab, 1 plate, 4 ref.

Descriptors: \*Fish reproduction, \*Cichlids, \*Fish genetics, \*Breeding, Bioassay, Testing procedures, Laboratory tests, Freshwater fish, Fish behavior, Aquaria, Animal pathology, Fish diseases, Laboratory animals, \*Toxicity testing.

A procedure is described for breeding Convict Cichlid tropical fish under laboratory conditions. Three generations of Convict Cichlids were bred successfully using this procedure and there was no significant incidence of deformities from inbreeding to the F3, which contrasts with a high incidence of skeletal deformities observed when Zebra Danio tropical fish were inbred to the F3 generation. The Convict Cichlid is a suitable species for laboratory toxicity testing, particularly studies to assess effects on breeding performance. (EIS-Deal)

W78-12994

#### TRACE METAL CONTENT OF A HERRING OIL AT VARIOUS STAGES OF PILOT-PLANT REFINING AND PARTIAL HYDROGENATION,

Saint Mary's Univ., Halifax (Nova Scotia). Dept. of Chemistry.

C. M. Elson, and R. G. Ackman.

Journal of the American Oil Chemist Society, Vol. 55, No. 8, p 616-618, 1978. 1 tab, 18 ref.

Descriptors: \*Herrings, \*Chemical analysis, Organic compounds, Cadmium, Arsenic, Mercury, Copper, Lead, Zinc, Public health, \*Trace elements, Metals, Fish physiology, Animal metabolism, Biochemistry, Proteins, \*Selenium.

Samples of a typical Atlantic herring oil at various stages of pilot-plant processing were analyzed for cadmium, selenium, arsenic, mercury, copper, lead, and zinc. The requirements for low levels of specific metals in edible oils were always difficult to meet completely in either a washed and bleached oil or in two lots of oil processed from one crude oil by the additional steps of partial hydrogenation and deodorization. The mercury content of the crude oil was relatively low and was not greatly affected by processing. The selenium level of 47 ppb in the crude oil was significantly lowered by hydrogenation and deodorization. Arsenic was removed by alkali-refining. The lead content was reduced by only 40% upon refining, probably because lead was present as an organometallic material. The concentration of the other heavy elements was generally lowered during processing. (EIS-Deal)

W78-13000



## Sources Of Pollution—Group 5B

## 5B. Sources Of Pollution

**NUMERICAL MODELLING OF LIQUID WASTE INJECTION INTO POROUS MEDIA SATURATED WITH DENSITY-STRATIFIED FLUID: A PROGRESS REPORT,** Hawaii Univ., Honolulu. Water Resources Research Center. Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 721, Price codes: A03 in paper copy, A01 in microfiche. Technical Memorandum Report No. 55, December 1977. 23 p, 5 fig, 89 ref, append. OWRT A-071-H(1), 14-34-0001-7026.

Descriptors: \*Injection, \*Finite element, \*Finite difference, Buoyant plume, Dispersion, Ghyben-Herzberg lens, Darcy's law, \*Mathematical models, \*Model studies, \*Path of pollutants.

Waste effluent injected into an aquifer saturated with denser ambient brackish salt water experiences a buoyant lift. As a result the effluent migrates both outward from the well and upward in response to the combined effects of injection head and buoyant force. After the injection process has begun several phenomena can affect the density, shape, and distribution in space and time of the resulting buoyant plume. The most important of these include convection and mechanical dispersion and molecular diffusion. Previous sandbox and Hele-Shaw laboratory modelling work provided a basic qualitative understanding of buoyant plume movement in a porous medium, but cannot correctly simulate dispersion phenomena which may have significant effects on buoyant plume movement and distribution. Thus it is necessary to mathematically model the problem using coupled sets of partial differential equations which take into account the effects of dispersion and diffusion as well as convection. For this problem there are four unknowns (density, concentration, velocity, and pressure) requiring four equations. The four governing equations are: motion (Darcy's law), continuity, dispersion, and state. Boundary and initial conditions must also be stipulated. This study used two sets of boundary conditions: conditions identical to those in the sandbox model studies, and geology models of a specific prototype area. Resulting governing equations and boundary and initial conditions are numerically solved by both the finite difference and element methods, and numerical models are calibrated with results of the sandbox model studies. Detailed formulation of the governing equations and initial and boundary conditions and preliminary finite difference modelling work are described.

W78-12102

**EFFECT OF RAINFALL AND SUBSEQUENT DRYING ON NITROGEN AND PHOSPHORUS CHANGES IN A DRYLAND FALLOW LOAM,** Department of Agriculture, Swift Current (Saskatchewan). Research Station. C. A. Campbell, V. O. Biederbeck, F. G. Warder, and G. W. Robertson. Soil Sci Soc Am Proc. 37(6), p 909-915, 1973.

Descriptors: Ammonification, Bacteria, Drying, Dryland, \*Loam(Fallow), Nitrates, Nitrification, \*Nitrogen, \*Phosphorus, \*Rainfall, \*Soil water movement.

<sup>36</sup>Chloride placed at 15- or 30-cm depth in 15-cm diameter cylinders of fallow loam was leached to at least 50 cm during and immediately following rainfall > 1.75 cm. As the soil dried following rainfall <sup>36</sup>Cl moved upwards. Nitrate content of leachates from a lysimeter experiment corroborated the leaching aspects of the <sup>36</sup>Cl experiment. In the 0- to 2.5-cm segment of a 2nd-yr fallow loam which was sheltered from rainfall, moisture was below the wilting percentage and NO<sub>3</sub>-N and bacterial numbers declined as the soil

gradually dried out. In the 2.5- to 15-cm segment, moisture was in the available range, yet moisture and NO<sub>3</sub>-N changes were small. In unsheltered fallow loam, NO<sub>3</sub>-N production in the 0- to 2.5-cm was primarily a function of soil moisture change: Delta NO<sub>3</sub>-N = -0.55-1.11 Delta M, (r = -0.94 (per thousand)), and Delta NO<sub>3</sub>-N = -0.45 - 0.56 Delta M, (r = -0.81 (per hundred)) in the 2nd- and 1st-yr fallow, respectively; (M = % moisture and Delta = daily change). The increase in NO<sub>3</sub>-N during drying seemed to be more a result of upward movement than of nitrification. There was a negative linear relationship between Delta NO<sub>3</sub>-N and Delta bacteria in the 0- to 2.5-cm soil segment. Sodium bicarbonate soluble inorganic P (IP) generally exceeded NaHCO<sub>3</sub> soluble organic P (OP). In 2nd-yr fallow, P was unaffected by environmental conditions. In 1st-yr fallow Delta IP in the 0- to 2.5-cm segment was directly related to rainfall (r = 0.98 (per thousand)), to Delta M (r = 0.97 (per thousand)), and to Delta bacteria (r = 0.88 (per thousand)), and inversely related to Delta NO<sub>3</sub>-N (r = -0.76). Copyright 1974, Biological Abstracts, Inc. W78-12109

#### ESTIMATING RUNOFF POLLUTION FROM LARGE URBAN AREAS—THE DELAWARE ESTUARY.

Rutgers-The State Univ., New Brunswick, NJ. W. Whipple, Jr., J. V. Hunter, R. C. Ahlert, and S. L. Yu.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 719, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute, Rutgers University, Completion Report, July 1978, 73 p, 17 tab, 11 fig. OWRT B-059-NJ(1), B-063-NJ(1), 14-31-0001-5128, 14-34-0001-7124.

Descriptors: \*Storm runoff, \*Pollutants, \*Biochemical oxygen demand, \*Urban hydrology, \*Urbanization, \*Delaware River, Water pollution, Water quality, Water pollution sources, Nutrients, Model studies, \*Nonpoint sources, \*Urban runoff, Water quality modeling.

Research has been conducted on methods of estimating nonpoint source pollution from large areas, illustrated by the Delaware Estuary. Analyses of the BOD reaction indicate no serious inadequacies, in this case, of the usual approaches based on first order decay estimated from BOD rate determinations. Existing modeling methodologies were analyzed, and suggestions made for improved approaches. Subsequent quantitative analysis was made on the basis of storm event loading determinations, related statistically to storm characteristics and to land use. Such results can be projected to future conditions, and extended to similar areas elsewhere by land use coefficients. Considerable data, obtained in the Trenton and Philadelphia areas, are compared to experience of other investigators and extended to the urban areas adjacent to the Delaware Estuary. Comparisons are made with estimates made by others for the National Commission on Water Quality, and for Section 208 studies of the Delaware Estuary Region. Although urban runoff loads from cities adjoining the estuary are of considerable significance, they are far exceeded by loadings which presumably originate from combined sewers, industrial effluents, and areas upstream in tributary watersheds. For water quality management of large areas, neither a delivery nor a source sampling approach is adequate, because all of the various sources of major pollution loadings are not evaluated by either; and the delivery ratio for various pollutants is not determined by either. A sampling strategy to provide sufficient data for a more complete analysis is outlined.

W78-12111

**DISTRIBUTION OF PHYTOPLANKTON IN VIRGINIA LAKES,** Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C. W78-12122

**DISTRIBUTION OF PHYTOPLANKTON IN TENNESSEE LAKES,** Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C. W78-12123

#### SEPTIC TANK DISPOSAL SYSTEMS AS PHOSPHORUS SOURCES FOR SURFACE WATERS.

Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences. R. A. Jones, and G. F. Lee.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 689, Price codes: A04 in paper copy, A01 in microfiche. Publication No EPA-600/3-77-129, November 1977. 61 p, 3 fig, 13 tab, 38 ref. R-804549.

Descriptors: \*Septic tanks, \*Phosphorus, \*Water pollution sources, \*Groundwater, \*Surface waters, \*Eutrophication, \*Path of pollutants, Waste water disposal, Nutrients, Nitrogen, Phosphates, Nitrates, Wisconsin, Voyager Village(WI), Effluents, Limiting factors.

Although other parameters indicated phosphate transport near an active septic tank wastewater disposal system in sandy substrate at Voyager Village recreational development (Burnett County, Wisconsin), groundwater monitoring during 1972-76 showed no evidence of transport. It is therefore concluded that septic tank systems generally do not contribute excessive amounts of phosphorus to surface waters by means of groundwater transport, a conclusion supported by earlier studies. Although no phosphorus transport was found, even at the monitoring point closest to the tile field (about 15 m down groundwater gradients), limited nitrate transport occurred. Transport of septic tank effluent down groundwater gradient was also indicated by patterns of specific conductance, chloride, and alkalinity. While phosphorus-limited lakes receiving such groundwater would not be degraded, lakes which are nitrogen-limited during the maximum algal growth period could have experienced increased aquatic plant growth. Water samples for this study were collected from wells up and down groundwater gradient from the tile field, and were analyzed for specific conductance, pH, sodium, chloride, potassium, magnesium, calcium, soluble orthophosphate, total phosphorus, and various forms of nitrogen. For rare situations in which phosphorus transport from septic tank effluents to surface waters could occur, sewerage collection or tank modification is recommended. (Lynch-Wisconsin)

W78-12125

**DISTRIBUTION OF PHYTOPLANKTON IN OHIO LAKES,** Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C. W78-12126

**DISTRIBUTION OF PHYTOPLANKTON IN NEW JERSEY LAKES,** Environmental Monitoring and Support Lab., Las Vegas, NV. For primary bibliographic entry see Field 5C. W78-12127

**DISTRIBUTION OF PHYTOPLANKTON IN GEORGIA LAKES,** Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C. W78-12128

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

**DISTRIBUTION OF PHYTOPLANKTON IN KENTUCKY LAKES,**  
Environmental Monitoring and Support Lab., Las Vegas, NV.

For primary bibliographic entry see Field 5C.  
W78-12129

**EFFECT OF STORMWATER ON STREAM DISSOLVED OXYGEN,**

Municipal Environmental Research Lab., OH.  
R. Smith, and R. G. Eilers.

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE4, Proceedings Paper 13932, p 549-559, August 1978. 5 fig, 1 tab, 8 ref, 2 append.

Descriptors: \*Storm water, \*Urban runoff, \*Combined sewers, \*Dissolved oxygen, \*Model studies, \*Mathematical models, \*Water pollution, \*Sewage, \*Overflow, \*Storms, \*Storm runoff, \*Dispersion, \*Effects, \*Streams, \*Cities, \*Analytical techniques, \*Computer models.

Closed-form and numerical integration solutions for the dissolved oxygen deficit response in natural streams with dispersion resulting from storm and combined sewer overflows were presented. The closed-form solution for an impulsive load can be used with the superposition principle to compute dissolved oxygen deficit concentration as a function of time and distance from the entry point of the stormwater overflow event. Computed values for the peak dissolved oxygen deficit and the time from entry where it occurs were expressed as single-valued functions of nondimensional groupings. (Sims-ISWS)  
W78-12139

**HORIZONTAL BUOYANT JETS IN QUIESCENT SHALLOW WATER,**  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.

For primary bibliographic entry see Field 8B.  
W78-12141

**WATER RESOURCES AND THE LAND-WATER INTERFACE,**

Illinois Univ. Urbana-Champaign. Dept. of Ecology, Ethology, and Evolution.  
J. R. Karr, and I. J. Schlosser.

Science, Vol. 201, No. 4352, p 229-234, July 21, 1978. 4 fig, 2 tab, 100 ref. EPA G005140, 68-01-3584.

Descriptors: \*Water resources, \*Water quality, \*Channel improvement, \*Vegetation effects, \*Sediments, \*Runoff, \*Nutrients, \*Fertilizers, \*Channel morphology, \*Vegetation, \*Temperature, \*Water temperature, \*Suspended solids, \*Erosion, \*Sedimentation, \*Streams, \*Channels, \*Land-water interfaces.

Development and implementation of local and regional plans to control nonpoint sources of pollution from agricultural land are major mandates of section 208 of Public Law 92-500. Many planners tend to equate erosion control as measured by the universal soil loss equation with improvements in water quality. Other implement channel management practices which degrade rather than improve water quality and thereby decrease the effectiveness of other efforts to control nonpoint sources. Planners rarely recognize the importance of the land-water interface in regulating water quality in agricultural watersheds. More effective planning can result from the development of 'best management systems' which incorporate theory from all relevant disciplines. (Sims-ISWS)  
W78-12164

**SULFUR ISOTOPE DISTRIBUTION IN SULFATES FROM SURFACE WATERS FROM THE NORTHERN JORDAN VALLEY, ISRAEL,**  
Weizmann Inst. of Science, Rehovot (Israel). Dept. of Isotope Research.

A. Nissenbaum.  
Environmental Science and Technology, Vol. 12, No. 8, p 962-965, August 1978. 2 fig, 4 tab, 11 ref.

Descriptors: \*Sulfur, \*Isotope studies, \*Salinity, \*Sampling, \*Chemical analysis, \*Surface waters, \*Lakes, \*Rivers, \*Springs, \*Rain water, \*Sea water, \*Water quality, \*Water pollution, \*Salts, \*Lake Kinneret (Israel), \*Jordan Valley (Israel), \*Israel, \*Saline springs.

Samples of surface waters from the Northern Jordan Valley, Israel, and Lake Kinneret (the Sea of Galilee) were analyzed for TDS, Cl, SO<sub>4</sub>, and S<sub>34</sub>/S<sub>32</sub> ratios of the dissolved sulfate. The delta S<sub>34</sub> values for sulfur isotopes ranged from around +4 parts per thousand in the fresh water to +19 to 23 parts per thousand in the saline springs. The regular increase in S<sub>34</sub>/S<sub>32</sub> with salinity was explained by a mixing model between rainwater-derived groundwater (delta S<sub>34</sub> = +4 to +9 parts per thousand) and slightly evaporated seawater (delta S<sub>34</sub> around +21 parts per thousand). The isotopic evidence argues against derivation of sulfate from oxidation of igneous or sedimentary sulfides, and the sulfidated that occurs in the saline springs may originate from bacteriogenic reduction of marine-derived sulfate, at depth. (Sims-ISWS)  
W78-12167

**ADVANCEMENTS IN OIL SPILL TRAJECTORY MODELLING,**

Dow Chemical Co., Freeport, TX. Process and Computer Engineering; and Texas A and M Univ., College Station.

D. R. Garver, and G. N. Williams.  
In: Oceans '78, 'The Ocean Challenge', Fourth Annual Combined Conference, Marine Technology Society and Institute of Electrical and Electronics Engineers, held in Washington, DC on 6-8 September 1978. p 441-444, 8 ref.

Descriptors: \*Oil pollution, \*Path of pollutants, \*Water pollution, \*Environmental effects, \*Resources development, \*Outer Continental Shelf, \*Trajectory modeling.

The continuing increase in offshore crude oil production and transportation is presently coupled with widespread concern over protection of the environment. This has led to interest by members of the petrochemical community in the development of suitable methods for quickly predicting the probable transport path and coastal impact time of a possible oil spill in the offshore environment. An oil slick simulator of the stochastic trajectory type has been enhanced in an effort to provide such methods. In particular, four areas are addressed. First, both the Fay radial spreading equations and a long-term dispersive algorithm are now provided. Additionally, the slick may now assume an elliptical shape. Secondly, wind and current forcing functions may now be generated with the use of Markov state transition matrices as well as through the use of input time histories. Thirdly, the model will adaptively calculate coefficients for the transport equations in an attempt to correct for deficiencies in the particular equations used. Finally, the model will now execute in a real-time mode with an on-line computer terminal to allow tracking to occur during an actual spill. (Sinha-OEIS)  
W78-12173

**MARINE POLLUTION IN KUWAIT,**  
Millersville State Coll., PA.

B. L. Oostdam.

In: Oceans '78, 'The Ocean Challenge', Fourth Annual Combined Conference, Marine Technology Society and Institute of Electrical and Electronics Engineers, held in Washington, DC on 6-8 September 1978. p 445-450, 3 fig, 7 ref.

Descriptors: \*Water pollution, \*Oil spills, \*Industrial wastes, \*Thermal pollution, \*Resources

development, \*Environmental effects, \*Pollution abatement, \*Outer Continental Shelf, Kuwait.

Rapid development of a single natural resource and resulting industrialization and urbanization have put a severe stress on the fragile nearshore environment off Kuwait. Major pollution hazards are oil spills, industrial wastes, thermal pollution, fecal coliform, and solid waste. Good progress is reported in abatement of ammonia and hydrogen sulphide, chief pollutants in the Shuaiba Industrial Area. In Shuaiba, mercury pollution from chlorine plants associated with large desalination plants appear localized. Thermal pollution constitutes recirculation problems and fecal coliform and solid waste are serious along the Kuwait City Waterfront. Although very active in international programs, improvements are required in local cooperation so as to establish an effective environmental protection program to counteract the strong industrial development interests. (Sinha-OEIS)  
W78-12174

**STRATIFIED WATER CIRCULATION FORECASTING FOR WATER QUALITY MANAGEMENT PLANNING IN THE COASTAL ZONE,**

Raytheon Co., Portsmouth, RI. Environmental and Oceanographic Services Dept.  
S. G. Chamberlain, P. V. Tawari, and W. J. Comery.

In: Oceans '78, 'The Ocean Challenge', Fourth Annual Combined Conference, Marine Technology Society and Institute of Electrical and Electronics Engineers, held in Washington, DC on 6-8 September 1978. p 451-455, 3 fig, 1 tab, 15 ref.

Descriptors: \*Water quality, \*Coasts, \*Forecasting, \*Management, \*Modeling, \*Environmental effects, \*Estuaries, \*Circulation, \*Rhode Island, \*Outer Continental Shelf, \*Coastal zone management.

Hydrodynamic and water quality models provide a capability to forecast the effects of coastal zone management decisions on waste-receiving coastal and estuarine waterways. This paper discusses the hydrodynamic component of the RAMSES Model, a management planning model designed to simulate stratified estuaries. The need for such a model to bridge the gap in complexity between the simple, but often limited, single layer models and the complex, but often expensive to apply, multi-strata models, is discussed. The model is described in terms of its basic hydrodynamic equations and its numerical solution approach. Processes incorporated in the model, including vertical entrainment and interfacial friction, are identified. The ability of the model to simulate stratified waterways is demonstrated by application to Penobscot Bay. (Sinha-OEIS)  
W78-12175

**OCEAN DISPOSAL IN THE MID-ATLANTIC BIGHT,**

Environmental Protection Agency, Philadelphia, PA.

For primary bibliographic entry see Field 5E.  
W78-12176

**SIGNIFICANCE OF PHENOLIC COMPOUNDS IN THE DELAWARE ESTUARY,**

Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.

For primary bibliographic entry see Field 5C.  
W78-12190

**INTERRELATIONSHIP OF GROUND AND SURFACE WATER QUALITY IN THE EL PASO-JUAREZ AND MESILLA VALLEYS,**

New Mexico State Univ., University Park. Coll. of Engineering.  
J. W. Hernandez.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Sources Of Pollution—Group 5B

Natural Resources Journal, Vol 18, p 1-9, January 1978. 5 ref, Spanish summary.

Descriptors: \*Water quality, \*Surface-ground-water relationships, \*International waters, Mexico, New Mexico, Texas, Rio Grande River.

Various facets of surface water quality in the region along the Rio Grande from San Marcial, New Mexico to Fort Quitman, Texas were analyzed in 1975 under the direction of the Bureau of Reclamation. Data regarding chemical, biological and physical characteristics of these waters are presented in this paper. One of the considerations is the relationship between the quality of surface and ground waters. This study concludes that (1) surface water quality influences that of shallow ground water in the area, (2) shallow ground water contains more salts than deeper ground water, (3) it is possible to extrapolate shallow ground water quality from the quality of the drains, and (4) there is little relationship between the quality of surface flow and the quality of the best artesian aquifer systems in the El Paso-Juarez area. (Russell-Arizona) W78-12225

**THE SALT BALANCE OF THE MEXICALI, B.C. IRRIGATION DISTRICT (EL BALANCE DE SALES DEL DISTRITO DE RIEGO DE MEXICALI, B.C.).** Escuela Nacional de Agricultura, Chapingo (Mexico). Dept. of Irrigation and Drainage. For primary bibliographic entry see Field 3C. W78-12226

**INTERNATIONAL EXTERNAL DISECONOMIES: THE COLORADO RIVER SALINITY PROBLEM IN MEXICO.** Escuela Nacional de Agricultura, Chapingo (Mexico); and Colorado State Univ., Fort Collins. Dept. of Economics. For primary bibliographic entry see Field 6E. W78-12231

**EFFECTS OF THE POLYCHLORINATED BIPHENYL AROCLOR 1254 ON GROWTH, SURVIVAL, AND BONE DEVELOPMENT IN BROOK TROUT (SALVE-LINUS FONTINALIS).** Fish and Wildlife Service, Columbia, MO. National Fisheries Research Lab. For primary bibliographic entry see Field 5C. W78-12236

**137CS AND POTASSIUM IN FISH AND LITTORAL PLANTS FROM A HUMUS-RICH OLIGOTROPHIC LAKE 1961-1976.** Lund Univ. (Sweden). Dept. of Radiation Physics. S. Carlsson, and K. Liden. Oikos, Vol 30, p 126-132, 1978. 3 fig, 3 tab, 35 ref.

Descriptors: \*Cesium, \*Potassium, \*Oligotrophy, \*Fallout, \*Radioisotopes, Fish physiology, Animal metabolism, Plant physiology, Lakes, Seasonal, Trophic level, Food chains, Oligotrophy, Tissue analysis, Bioaccumulation.

Results of a 15 yr long-term study of the concentration of 137Cs from fallout in some species of fish and littoral plants in a humus-rich oligotrophic lake are presented. High concentrations of 137Cs were detected in the different species studied. This is in agreement with the general observation that organisms in oligotrophic lakes have higher concentrations of the radionuclide than in lakes of other limnological types. The maximum values of the concentration of 137Cs were found in 1964 or 1965, depending on the species studied. Since then the concentration of the radionuclide has decreased and in 1975 it was 20-30% of the maximum value. A seasonal variation in the concentration of 137Cs in fish was noted with the highest value during the first quarter of the year. This is explained by the strong temperature dependence

of the excretion of 137Cs. No seasonal variation in the concentration of potassium was seen in fish. In the various species of fish studied a relationship was derived between the concentration of 137Cs and the size of the fish. The results are discussed in terms of changes in feeding habits and changes in the excretion of the radionuclide. The concentration of 137Cs in fish was observed to follow trophic level increase. The concentration is increased by a factor of two between each level. (EIS-Deal) W78-12238

**RECHERCHES DE POLLUANTS CHIMIQUES DANS LE TISSU GRAISSEUX D'UN DAUPHIN ECHOUE SUR LA COTE MEDITERRANEE (CHEMICAL POLLUTANTS IN BLUBBER TISSUE OF A DOLPHIN AGROUND ON THE MEDITERRANEAN COAST).** Aix-Marseille-2 Univ. (France). Lab. de Biologie Marine. N. Vincente, and D. Chabert. Oceanologica Acta, Vol. 1, No. 3, p 331-334, 1978. 1 fig, 26 ref.

Descriptors: \*Pesticide residues, \*Polychlorinated biphenyls, \*Toxicity, Heavy metals, Metals, Copper, Cadmium, Lead, DDT, DDE, DDD, Pesticide toxicity, Mortality, Organic compounds, Path of pollutants, Water pollution effects, Environmental effects, Animal metabolism, Chlorinated hydrocarbon pesticides, Mammals, \*Tissue analysis, \*Bioaccumulation, \*Dolphin.

Analyses of blubber tissue from a common dolphin (Delphinus delphis) aground on the French Mediterranean coast, show a relatively low concentration of heavy metals in microg/g wet weight for an animal at the top of the food chain: Cu, 32.5 ppm; Cd, none detectable; Pb, 3.3 ppm. On the other hand, concentrations of organochlorines (in microg/g dry weight) are very high: pp-DDT=324 ppm; pp-DDE=75 ppm; pp-DDD=2.7 ppm; gamma HCH=4 ppm; DP6=700 ppm. These concentrations, and particularly the concentration of PCB (DP6) are the highest so far observed by the authors, and were probably the cause of the death of the animal. (EIS-Deal) W78-12240

**BIODEPOSITED TRACE METALS AND MINERAL CONTENT STUDIES OF SOME TROPICAL MARINE ALGAE.** Universiti Sains Malaysia, Penang. Pusat Pengajian Sains Kajiayut. P. M. Sivalingam. Botanica Marina, Vol. 21, p 327-330, 1978. 1 fig, 2 tab, 8 ref.

Descriptors: \*Metals, \*Marine algae, \*Cyanophyta, \*Rhodophyta, \*Phaeophyta, \*Chlorophyta, Zinc, Cadmium, Potassium, \*Sodium, Magnesium, Manganese, Phosphorus, Copper, Lead, Heavy metals, Water quality, Water analysis, Deposition (Sediments), Tropical regions, Monitoring, \*Biodeposition.

Investigations on the concentrations of trace metals in the waters of Batu Ferringhi, Penang Island, indicated that they fall within the category of water-type I for unpolluted waters. In collaboration studies on the biodeposited trace metals in one species of Cyanophyta, 9 of Rhodophyta, 4 of Phaeophyta and 6 of Chlorophyta showed values of a fairly high level as compared to those reported for benthic marine algae found in the same water-type category in the Oresund area (Sweden) with the exception of the element Zn which appeared to show corresponding values. Further, no significant correlation of the biodeposited trace metals among the algal groups was observed. Consequently, some algal species, though living in the unpolluted water-type I, had biodeposited trace metals of Zn, Cu, and Pb at concentrations of above 100, 20 and 10 ppm, respectively, which are values only observable in

algal species from polluted areas. Concurrent studies on the biodeposited concentrations of elements such as Ca, K, Na, Mg, Mn, and P also showed similar trends as those of the trace metals mentioned above. Based on this investigation, the author proposed that certain algal species within the tropical zone could be employed as indicators for pollution studies in the near future. (EIS-Deal) W78-12244

**DISTRIBUTION AND IMPORTANCE OF PHYTOPLANKTON IN THE ATCHAFALAYA BASIN.** Nevada Univ., Las Vegas. Dept. of Biological Sciences. For primary bibliographic entry see Field 5C. W78-12246

**DISTRIBUTION OF PHYTOPLANKTON IN DELAWARE LAKES.** Environmental Monitoring and Support Lab., Las Vegas, NV. For primary bibliographic entry see Field 5C. W78-12248

**ACTIVATED SLUDGE DEGRADATION OF NITRILTRIACETIC ACID (NTA)-METAL COMPLEXES.** Environmental Protection Service, Ottawa (Ontario). Wastewater Technology Centre. E. E. Shannon, N. W. Schmidtke, and B. A. Monaghan. Technology Development Report EPS 4-WP-78-5, August, 1978, 16 p, 5 fig, 18 ref, 3 tab.

Descriptors: \*Activated sludge, \*Sludge digestion, \*Nitrilotriacetic acid, \*Biodegradation, Toxicity, \*Chemical degradation, Metals, Aquatic environment, Temperature, Waste water treatment, \*Bench scale batch experiments.

Bench scale batch activated sludge experiments were conducted to determine the biodegradability of nitrilotriacetic acid (NTA) complexes with calcium (Ca), iron (Fe), lead (Pb), chromium (Cr), copper (Cu), zinc (Zn), cadmium (Cd), nickel (Ni) and mercury (Hg). Degradation rates were evaluated at NTA levels of 8 and 16 mg per L as H3NTA, temperatures of 5 degrees and 15 degrees C, and various metal concentrations. It was determined that the NTA complexes with Ca, Fe, Al, Pb, Cr, Cu and Zn at temperatures of 10 degrees to 15 degrees C degraded readily, with first-order degradation coefficients in the range of minus 0.05 to minus 0.10 per hr. The heavy metal NTA complexes of Cd and Ni and Hg degraded poorly, with degradation coefficients of less than minus 0.02 per hr. With the exception of NTA complexes with Zn, all degradation rates were reduced considerably at 5 degrees C. The apparent degradation coefficient of zero for mercury is suspected to be due to a toxic effect on the activated sludge rather than to the formation of a bio-resistant complex. These experiments, reinforced by observations of other related studies, led to the conclusion that buildup of NTA in the aquatic environment even during low winter temperatures is extremely unlikely. (WATDOC) W78-12250

**SOURCES OF METALS AND METAL LEVELS IN MUNICIPAL WASTEWATERS.** Ontario Ministry of the Environment, Toronto. Pollution Control Branch. E. D. Atkins, and J. R. Hawley. Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 80, Environmental Protection Service, Environment Canada, Ottawa, Canada, 408 p, 24 ref, 97 tab. (1978). 75-1-43.

Descriptors: \*Metals, \*Municipal water, \*Industrial wastes, \*Municipal wastes, \*Waste water (Pollution), Sludge, Sludge digestion, Sludge disposal, Sewage treatment, Sewage sludge treat-



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

ment, Sewers, Effluent streams, Influent streams, Waste storage, Storm drains, Bleaching wastes, Data collections, Canada, \*Metal levels, \*Point-source treatment, \*End-of-the-pipe treatment.

The main objective of this study was to compile information on typical sources of metals and metal levels in municipal wastewaters and to assess the relative benefits of point-source or end-of-the-pipe treatment for metals. The specific metal content of a large number of Ontario sewage plant influents, sludges and effluents is recorded in detail for the first time. This was done through a detailed sampling program at selected sewage treatment plants and through a review of the records of the Ontario Ministry of the Environment. Metal removal efficiencies are also recorded and range from 35 percent (low estimate) for lagoon-type treatment plants to 76 percent for activated sludge plants. The sewer-use by-laws of 57 Ontario municipalities were surveyed, showing that there is a wide fluctuation in metal levels allowed by them. It is recommended that these be standardized by strict implementation of a province-wide sewer-use by-law. The complete elimination of all industrial discharges to sanitary sewers would lower metal concentrations in sewage plant influents, sludges and effluents, but the survey indicates that significant problems would still remain because of the metal content of 'domestic' sewage. A product index, in which the general chemistry of each category is summarized, and a metal index which groups household products according to their contents, are included in this report. (WATDOC) W78-12251

**DISSOLUTION OF ARSENIC FROM WATER-LOGGED AND AERATED SOIL,** Missouri Univ.-Columbia. Dept. of Agronomy. R. E. Hess, and R. W. Blanchard. *Journal of Soil Science Society of America*, Vol. 41, No. 5, Sept-Oct 1977, p 861-865. 1 fig, 1 tab, 16 refs. OWRT A-068-MO(3), 14-31-0001-4025 and 5025.

Descriptors: \*Arsenate solubility, \*Aluminic arsenate, Iron arsenate, Calcium arsenate, Lead arsenate, Manganese arsenate, Soil analysis.

Sharpsburg and Menfro soils containing 320 and 160 micro g As/g, respectively, were waterlogged with water or 1% dextrose. The Eh reached a minimum of -150 mV after 1 day of incubation and increased to about +300 mV after 12 days for both soils in 1% dextrose. The Eh remained constant in the Sharpsburg soil during incubation with water, but gradually decreased in the Menfro soil. In the 1% dextrose solution, As increased rapidly in both soils and became constant after 12 days. The As in solution increased more slowly when incubated with water, but also remained constant after 12 days. After freeze-drying and exposing the soil to the atmosphere, Eh increased and As decreased to initial levels. The values of pAl + 3pOH, pAl + pAsO<sub>4</sub>, pFe + 3pOH, pFe + pAsO<sub>4</sub>, 3pMn + 2pAsO<sub>4</sub>, 3pCa + 2pAsO<sub>4</sub>, and 3pPb + 2pAsO<sub>4</sub> were computed. These measurements indicated that the soil solution of the Menfro and Sharpsburg soils contained less As than predicted for Mn and Pb arsenates. W78-12267

**EVALUATION OF DRAINAGE - WATER TABLE CONTROL SYSTEMS USING A WATER MANAGEMENT MODEL,** North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering. For primary bibliographic entry see Field 4A. W78-12274

**COLUMN CHROMATOGRAPHY FOR FIELD PRE-CONCENTRATION OF TRACE METALS,** North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering. For primary bibliographic entry see Field 5A. W78-12275

**EFFECTS OF SKI AREA DEVELOPMENT AND USE ON STREAM WATER QUALITY OF THE SANTA FE BASIN, NEW MEXICO,** New Mexico Univ., Albuquerque. Dept. of Biology. J. R. Gosz.

*Forest Science*, June 1977, Vol. 23, No. 2, p 167-179, 7 fig, 4 tab, 19 ref. OWRT B-053-NMEX(2).

Descriptors: Nutrients, Cycling nutrients, \*Water pollution sources, Environmental effects, \*Water quality, \*Santa Fe basin(N Mex), \*Ski area development, Sangre de Cristo Mountains, \*New Mexico.

Studies have been made of a series of ski area developments in the Sangre de Cristo Mountains of New Mexico, U.S.A. These developments represent increasing impact severity on a single area as well as different areas subject to different types of impacts. Studies of nutrient budgets and water quality showed that the major factor affecting water quality was road salt application. Sewage disposal affected water quality to a minor degree while poma lift construction and light tree removal had no measurable effect on the water quality parameters studied. (Stockton-N Mex St) W78-12277

**CHARACTERIZATION OF URBAN RUNOFF,** Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst. W. Whipple, Jr., B. B. Berger, C. D. Gates, R. M. Ragan, and C. W. Randall. *Water Resources Research*, Vol. 14, No. 2, April 1978, p 370-372. 5 tab, 9 ref. OWRT C-5341 (No 4239)(10), 14-31-0001-4239.

Descriptors: \*Water quality, Water pollution, Heavy metals, Nutrients, Suspended solids, \*Storm sewers, \*Urban hydrology, Biochemical oxygen demand, \*Urban runoff pollution, Storm hydrograph loading, Storm event loadings, Unrecorded pollution.

Unrecorded pollution and nonpoint sources are too important to be neglected in water quality analysis, but the findings in the literature have been too scattered in place and time, and too diversely reported, to have been fully accepted. Such pollution is usually referred to as nonpoint source pollution, or in developed areas as urban runoff, in spite of the fact that considerable parts of it are delivered by large storm sewers and may originate partly from unrecorded urban point sources. For convenience, this usual terminology is employed in this paper. The work of each of five participating institutes was designed to evaluate urban runoff pollution from areas within that state and to relate those findings to differences in land use. Results have been reported in detail in the separate reports by the respective investigators. This report summarizes these findings and then draws conclusions which the five principal investigators agreed upon. W78-12279

**PHOSPHORUS INTERACTIONS WITH STREAM-BED SEDIMENTS,** South Dakota School of Mines and Technology, Rapid City. Dept. of Civil Engineering. L. L. Harms, P. H. Vidal, and T. E. McDermott. *Journal of the Environmental Division, American Society of Civil Engineers*, Vol 104, No EE2, Proceedings Paper 13682, p 271-288, April 1978. 10 fig, 3 tab, 24 ref, 1 append. OWRT B-046-SDAK(2).

Descriptors: \*Phosphorus, \*Sediments, \*Streambeds, \*South Dakota, Scour, Flow, Streamflow, Streams, Rivers, Water pollution, Water pollution sources, Sorption, Pollutants, Path of pollutants, Unsteady flow, High flow, Suspended solids, On-site investigations, \*Rapid Creek(SD).

The objective of this research was to determine the role of stream bed sediments with respect to increased phosphorus concentrations during high flow periods. Both point and nonpoint sources were considered. Core samples of sediments were evaluated for total and organic phosphorus content. Total phosphorus, total filtrable phosphorus, and filtrable orthophosphate were determined on water samples. Stream bed sediments play a major role with respect to increased phosphorus concentrations of streams during high flow periods. (Sims-ISWS) W78-12280

**A MATHEMATICAL MODEL OF REGULATIONS IN POPULATION DYNAMICS OF PLANKTONIC BACTERIA AND DIATOMS IN SEVASTOPOL BAY (IN RUSSIAN),** Institute of Biology of the Southern Seas, Sevastopol(USSR). I. I. Kryshev, and Yu. A. Gorbenko. *Gidrobiol Zh* 13(2), p 51-55, 1977.

Descriptors: \*Mathematical models, Biomass, Diatoms, Plankton, Water pollution, \*Aquatic ecosystems, Model studies, Ukrainian-SSR, USSR, \*Volterra model.

Changes in the biomass of planktonic bacteria and diatoms in Sevastopol Bay (Ukrainian SSR, USSR) were studied in 1966-71. Coefficients for the Volterra model of a planktonic ecosystem were determined, and theoretically calculated values were compared with actual data. The Volterra Model, even in its simplest variant, gave fully satisfactory results in describing aquatic ecosystems.--Copyright 1978, Biological Abstracts, Inc. W78-12282

**DYNAMIC COPPER BALANCE IN A FRESH-WATER LAMELLIBRANCH SENTINEL: EFFECTS OF SUSPENDED MATTER (IN FRENCH),** Unite Enseign. Rech. Sci. Lab. Ecol. Biol. Gen., Limoges, Fr. C. Chaisemartin. *CR Seances Soc Biol Fil* 17(3), p 619-626, 1977.

Descriptors: \*Copper, \*Mussels, \*Suspended solids, Sediments, Water pollution effects, Water pollution sources, Margaritifera-Margaritifera.

The fresh-water pearl mussel *Margaritifera margaritifera* was used as a bio-indicator in a study of mass Cu balance between sediment and suspended matter. The amount of Cu in the target species is a function of the balance between species contamination and surrounding contamination.--Copyright 1978, Biological Abstracts, Inc. W78-12283

**MICROBIOLOGICAL STATE OF THE KIEV RESERVOIR IN THE SIXTH-SEVENTH YEARS OF ITS EXISTENCE (IN RUSSIAN),** Akademiya Nauk USSR, Kiev. Instytut Hidrobiologii. L. E. Mikhailenko, L. A. Khoroshikh, and E. I. Dukhovnaya. *Gidrobiol Zh* 13(2), p 45-50, 1977.

Descriptors: \*Microbiology, Kiev Reservoir(USSR), Regulation, Reservoir operation, Mesotrophy, \*Bacteria, Biomass, Plankton, Zooplankton.

Data on quantitative development of bacterial populations in the reservoir are presented. The total bacteria content and amount of saprophytes were lower in the same region before regulation of the river. The annual bacterial flow from the reservoir was less than those incoming from the tributaries: The role of allochthonous bacterioplankton as a whole was insignificant. The average annual daily income was not in excess of 2% of the

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Sources Of Pollution—Group 5B

average annual stock. Bacterial reproduction rates indicate that the reservoir is of the mesotrophic type. On the average, 7.2 kcal/m<sup>2</sup> of bacterial biomass was produced/surface unit in summer and was consumed mainly by zooplankton.—Copyright 1978, Biological Abstracts, Inc.  
W78-12297

**MACRO-NUTRIENTS IN THE LAKE GEORGE ECOSYSTEM.**  
Rensselaer Polytechnic Inst., Troy, NY.  
For primary bibliographic entry see Field 5C.  
W78-12304

**THE USE OF CARBON AND SULFUR ISOTOPIC RATIOS AND TOTAL SULFUR CONTENT FOR IDENTIFYING THE ORIGIN OF BEACH TARS IN SANTA MONICA BAY, CALIFORNIA.**  
University of Southern California, Los Angeles.  
Sea Grant Program.  
B. A. Hartman.

M.A. Thesis, Southern California University Sea Grant Program Thesis/Dissertation Series No. USCSG-TD-02-78, June 1978. 112 p, 18 fig, 6 tab, 32 ref, 5 append. SG-04-6-158-4418.

Descriptors: \*Oil pollution, \*Seepage, \*Oil spills, Chemical analysis, Water pollution sources, California, \*Tars, \*Santa Monica Bay(CA).

Carbon and sulfur isotopic ratios and total sulfur content are evaluated as chemical fingerprints for highly weathered petroleum in the marine environment. Analysis is confined strictly to the asphaltene fraction of petroleum owing to the insensitivity of the fraction to weathering processes. The technique is applied to the problem of the source identification of tar depositing on the coastline adjacent to metropolitan Los Angeles, California. Comparison of the same parameters from beach tars collected during the 1976-1977 years to the parameters of the potential source oil suggests that 51% of the tars in Santa Monica Bay are derived from natural oil seepage at Coal Oil Point, 31% from natural oil seepage in Santa Monica Bay, and 18% from unknown sources. The chemical data, coupled with seasonal monitoring of tar deposition and slick size at oil seeps, allow models of tar transport to be deduced. The ultimate fate of tars depositing in Santa Monica Bay is transport into the Santa Monica Basin and incorporation into the sediment column. (NOAA)  
W78-12311

**DISCHARGE OF ALKANES DURING OFFSHORE OIL PRODUCTION IN THE BUCANEER OILFIELD.**  
Houston Univ., TX. Dept. of Biophysical Sciences.  
B. S. Middleditch, B. Basile, and E. S. Chang.  
Bulletin of Environmental Contamination and Toxicology, Vol 20, p 59-65, 1978. 2 tab, 4 ref.

Descriptors: \*Brines, \*Oil spills, \*Oil, \*Brine disposal, Aromatic compounds, Organic compounds, Oil pollution, Path of pollutants, Water pollution sources, Gas chromatography, Industrial wastes, Oil wells, Gulf of Mexico, \*Crude oil, Alkanes, Buccaneer oil field.

We have characterized the alkane content of the discharged brine from both production platforms in the Buccaneer oilfield over a period of eleven months. The mean concentration of C12-C36 alkanes was approximately 2 ppm (2mg/l). The mean rate of discharge of brine in the field is approximately 600 bbl (95,400 l) per day. The mean rate of discharge of alkanes per day, therefore, is 191 g. Additional research is required to determine the rate of dispersion of these alkanes, their pool size in the vicinity of the production platforms, and their significance relative to alkanes of biogenic origin. (EIS-Deal)  
W78-12355

**PATTERNS OF TRACE METAL ACCUMULATION IN CRAYFISH POPULATIONS.**  
Northern Illinois Univ., De kalb. Dept. of Biological Sciences.

R. V. Anderson, and J. E. Brower.  
Bulletin of Environmental Contamination and Toxicology, Vol 20, p 120-127, 1978. 5 tab, 21 ref.

Descriptors: \*Cadmium, \*Lead, \*Crayfish, Metals, Heavy metals, Copper, Zinc, Spectrophotometry, Bioindicators, Path of pollutants, Animal metabolism, Animal physiology, Biochemistry, Monitoring, Tissue analysis, Bioaccumulation.

The effectiveness of crayfish as indicators of variation in trace metal input was found to be dependent on the physiological role of the metal. This was particularly true with sublethal environmental concentrations. As shown, the animals can control body concentrations of physiologically important metals. Cadmium and lead which do not have a physiological function occur in concentrations associated with environmental input. The crayfish, therefore, may be used to monitor inputs of these metals. (EIS-Deal)  
W78-12358

**MERCURY CONCENTRATIONS IN PACIFIC HAKE, MERLUCCIIUS PRODUCTUS (AYERS), AS A FUNCTION OF LENGTH AND LATITUDE.**  
Oak Ridge National Lab., TN.

N. H. Cutshall, J. R. Naidu, and W. G. Pearcy.  
Science, Vol 200, p 1489-1491, 1978. 1 fig, 2 tab, 29 ref.

Descriptors: \*Mercury, Size, Weight, Fish physiology, Animal metabolism, Heavy metals, Latitudinal studies, Fish behavior, Food habits, Water analysis, Path of pollutants, Industrial wastes, Commercial fish, Tissue analysis, Bioaccumulation, \*Hake, Merluccius.

Mercury concentrations in Pacific hake increase with fish size and with the latitude of collection. While the mercury-size trend is consistent with data for other species, the latitudinal trend is opposite to that reported for other fishes over the same geographical area. Consequently, latitudinal trends of mercury concentrations in fishes do not necessarily indicate trends of mercury concentrations in water. Food habits and metabolism may cause the observed variations. (EIS-Deal)  
W78-12359

**UPTAKE OF GLYCOLIC ACID BY A MARINE BIVALVE.**  
Florida State Univ., Tallahassee. Dept. of Oceanography.  
For primary bibliographic entry see Field 5C.  
W78-12361

**COMPOUNDS TOXIC TO FISH IN PULP MILL WASTE STREAMS.**  
British Columbia Research Council, Vancouver.  
For primary bibliographic entry see Field 5C.  
W78-12370

**FORMS OF IRON IN RIVER WATERS.**  
Hokkaido Univ., Hakodate (Japan). Lab. of Marine Chemistry.  
S. Fukase, K. Matsunaga, and Y. Maita.  
Bulletin of the Faculty of Fisheries of Hokkaido University, Vol. 29, No. 1, p 65-69, 1978. 3 fig, 2 tab, 8 ref.

Descriptors: \*Iron, \*Phytoplankton, \*Humic, \*Fulvic acids, Metals, Sediments, Acids, Organic acids, Ions, Chemical analysis, Water analysis, Rivers, \*Ligands.

Iron complexes with humic substances isolated from river sediments and decomposition products

of phytoplankton were investigated with an anion exchange column. It was found that iron complexed only with humic substances and the complexes had negative charges. Dissolved, particulate (0.45-0.025 microns) and particulate (greater than or equal to 0.45 microns) iron in river waters were 25, 35, and 41% in total iron, respectively. Dissolved iron existed in river waters as complexes with humic substances and the residues or iron hydroxide or colloidal humic substances. (EIS-Deal)  
W78-12371

**A MULTIPLE APPROACH TO SOLVING THE GAS SUPERSATURATION PROBLEM.**  
Corvallis Environmental Protection Agency.  
Western Fish Toxicology Station.  
For primary bibliographic entry see Field 5C.  
W78-12377

**PARASITIC INFECTIONS IN BLACK CHILDREN IN AN ENDEMIC SCHISTOSOMIASIS AREA IN NATAL.**  
South African Medical Research Council, Potchefstroom.  
C. H. Schutte, J. M. Van deventer, and J. M. Eriksson.  
South African Medical Journal (Cape Town), Vol 51, No 9, p 268-272, 1977.

Descriptors: \*Human parasites, \*Waterborne diseases, Public health, Eggs, Cercariae, Entamoeba, Taenia, Ascaris, Bilharzia, \*Schistosomiasis, Schistosoma haematobium, Hookworm, Strongyloides, Eimeria, Hymenolepis, \*Natal, South Africa.

Urine and stool specimens from 856 school children aged from 7 to 20 years, and from 80 Preschool children, were examined for Schistosoma haematobium and intestinal helminths and protozoa. S. haematobium was present in 57% with a peak of 81% in 13-14 year old children. Peak intensity preceded peak incidence and egg loads gradually decreased with age. There was no clear-cut difference between boys and girls with regard to intestinal parasites, nor was there a close correlation between the incidence of Schistosoma spp and that of the intestinal parasites. There was a considerable reduction in the incidence of Ascaris lumbricoides and Trichuris trichiura infestation with age. (So Afr Water Info Ctr)  
W78-12396

**SOUTH AFRICAN MARINE POLLUTION SURVEY REPORT 1974-1975.**  
Council for Scientific and Industrial Research, Johannesburg (South Africa).  
C. E. Cloete, and W. D. Cliff.  
South African National Scientific Programmes Unit Report No. 8, 1976, 65 ref, 16 fig, 6 tab.

Descriptors: \*Marine pollution, \*Estuaries, Thermal pollution, Radioactive pollutants, Fish processing wastes, Heavy metals, Bioindicators, Bacteria, Mercury, Table Bay, Richards Bay, Cape Peninsula, Saldanha Bay, Umbogintwini, Natal, Umzimkulu River, Berg River, Kosi Bay, Umlalazi River, Amatikuli River, Umgeni River, Ifafa River, Umtamvuna River, \*South Africa.

A national marine pollution survey was initiated in 1974 to determine and assess pollution around the coast of South Africa. Impact area surveys, coastal of (including estuarine) reference surveys and oceanic reference surveys were undertaken. This report presents the results of the surveys undertaken up to the end of 1975. The impact areas studied were Richards Bay, the Durban area, sites on the Cape peninsula and Saldanha Bay. Coastal reference transects were undertaken as Umbogintwini and the Fynlands sewage outfall (both between Durban Bay and Isipingo) and the Umzimkulu and Berg River estuaries were in-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

vestigated. Results of earlier surveys of Kosi Bay and the Umlalazi, Amatikulu, Umgeni, Ifafa and Umtamvuna estuaries are also given. East coast oceanic reference transects were undertaken quarterly during 1974 and 1975, while the south and west coast transects were samples on four cruises during 1975. Finally, results are given of some genera pollution studies as well as studies of coastal water dynamics north of Cape Town. (So Afr Water Info Ctr)  
W78-12400

**BIBLIOGRAPHY ON MARINE POLLUTION IN SOUTH AFRICA**, Council for Scientific and Industrial Research, Johannesburg (South Africa). D. A. Darracott, and C. E. Cloete. South African National Scientific Programmes Unit Report No. 5, 1976, 337 ref.

Descriptors: \*Viruses, Bacteria, \*Bibliographies, \*Marine pollution, Marine fisheries, Mollusca, Radioactive pollutants, Marine biology, Mariculture, Ecology, Environmental impact studies, Heavy metals, Fish processing wastes, Oil spills, Thermal pollution, Estuaries, \*South African, East Coast, West coast.

The bibliography was compiled at the request of the Marine pollution section of the National Programme for environmental Sciences, and covers the following subjects: Field studies of chemical pollutants introduced by man into the South African marine environment. Marine pollution related techniques and methods. The prevention and combating of marine pollution. \*Natural pollution from 'Red tides' Coastal currents and free hydrographic conditions. Sediment transport, marine biology and ecology. (So Afr Water Info Ctr)  
W78-12404

**MATHEMATICAL MODELS FOR SIMULATING MONTHLY WATER LEVELS AND SALINITIES IN SHALLOW LAKES**, University of the Witwatersrand, Johannesburg (South Africa). For primary bibliographic entry see Field 2L.  
W78-12411

**HYDROCHEMICAL CHARACTERISTICS OF THE GORYN RIVER AND SOME OF ITS TRIBUTARIES (IN RUSSIAN)**, Akademiya Nauk URSS, Kiev. Inst. Hidrobiologii. A. D. Konenko, I. D. Garasevich, and I. V. Grib. *Gidrobiol zh* 13 (4), p 101-106, 1977.

Descriptors: \*Domestic wastes, Water pollution sources, Calcium, \*Industrial wastes, \*Nitrogen, \*Phosphorus, Self-purification, USSR, Wastes.

A literature review and observations indicated that the Goryn River basin (USSR) has a significant concentration of mineral and organic compounds of N and P. In areas below populated points, the sanitary quality of the water in rivers of this basin is reduced. Waters of the Goryn River and its largest tributary, the Sluch River, are moderately mineralized and belong to the hydrocarbonate class, Ca group. The Ustye, a lesser tributary is most seriously affected by industrial and household wastes, which occasionally alter the class and group of its water. Self-purification processes are intensive enough in all 3 of the studied rivers to make their waters qualify for the most part as pure and conditionally pure. Copyright 1978, Biological Abstracts, Inc.  
W78-12462

**THE DISTRIBUTION OF NUTRIENTS IN SWARTVLEI, A SOUTHERN CAPE COASTAL LAKE**, Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies. C. Howard-Williams.

Water, South Africa, Vol. 3, No. 4, p 213-217, 1977. 21 ref, 3 tab, 2 fig.

Descriptors: \*Nutrient distribution, \*Lake sediments, Macrophytes, \*Nitrogen, \*Phosphorus, Sediment analysis, Water analysis, Distribution patterns, Aquatic plants, Littoral zone, Plant tissue analysis, Standing stock, \*Swartvlei, \*South Africa, Oligotrophic lakes.

Like most other Southern Cape coastal lakes, Swartvlei has a large aquatic macrophyte community. As part of a continuing study to understand the role of these macrophyte beds, data on nutrient stocks in Swartvlei have been compiled. This paper gives nitrogen and phosphorus values in the macrophytes, the sediments and the waters of Swartvlei, and discusses the distribution patterns of these elements in the lake. (So Afr Water Info Ctr)  
W78-12493

**INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: BENZOTRIAZOLES**, Syracuse Research Corp., NY. Center for Chemical Hazard Assessment.

L. N. Davis, J. Santodonato, P. H. Howard, and J. Saxena. Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 366, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency, Office of Toxic Substances, EPA 560/2-77-001, Feb. 1977. 14 fig, 45 tab, 240 ref.

Descriptors: \*Chemical wastes, \*Toxicity, \*Corrosion control, Ultraviolet radiation, Corrosion, Path of pollutants, Oxidation, Hydrolysis, Chemical reactions, Environmental effects, Antifreezes, Plastics, Water pollution effects, Water pollution sources, Films, Copper, \*Benzotriazoles, \*Carcinogens, \*Mutagens.

Benzotriazoles are produced in approximately 5-6 million pounds per year in the United States. The majority are used in anticorrosion applications. Approximately 20-30% are used as UV stabilizers, many of which are 2-substituted benzotriazoles. Small amounts are used for photographic applications. Information on production, use, transport and handling, environmental fate and toxicity are reviewed. (EIS-Katz)  
W78-12513

**EXCRETION OF MERCURY FROM FISH (IN JAPANESE)**, Tokyo Univ. of Fisheries, (Japan). T. Kikuchi, H. Honda, M. Ishikawa, H. Yamanaka, and K. Amano. Bulletin of the Japanese Society of Scientific Fisheries, Vol 44, No 3, p 217-222, 1978. 1 tab, 11 fig, 8 ref.

Descriptors: \*Mercury, \*Heavy metals, \*Path of pollutants, \*Self-purification, \*Eels, \*Marine fish, \*Absorption, \*Fish diets, Fish, Aquatic animals, Public health, Toxicity, Laboratory tests, Excretion, Tissue analysis, Decontamination, \*Seabream, Astroconger, Chrysophrys, Bioaccumulation.

The possibility of removing mercury from fish heavily contaminated by methyl mercury was examined in two series of rearing experiments using two marine species of fish: conger eel and the sea bream. In the first series, conger eel, caught from Kagoshima Bay, which had natural levels of mercury of 1.0 ppm in the muscle tissue, 0.67 ppm in the spleen, and 1.8 ppm in the liver, were kept in plain sea water and fed with raw fish flesh for seven weeks. The mercury levels were reduced to one-half in 5 weeks for the muscle and spleen, and in 3 weeks for the liver. In the second series, sea bream were fed for 7 weeks with pellets containing either methyl mercury or mercuric chloride at a

level of 1.0 ppm, and subsequently fed with either commercial pellet feed or pellets impregnated by a mixture of cysteine, pectin, and chitosan for another 7 weeks. The mercury concentrations at the end of the first feeding period were 0.9 ppm in the kidney and 0.25-0.4 ppm in the muscle, liver, brain, and spleen. However, during the subsequent feeding period, the mercury level was reduced to a level less than 0.2 ppm in every tissue examined, with best results in the group fed with the pellets supplemented by the mixture mentioned. In the case of feeding with pellets containing mercuric chloride, the mercury level in any part hardly reached the level of 0.2 ppm, even after a 7 weeks' period. This may suggest that mercury in this chemical form will excrete readily. (EIS-Katz)  
W78-12515

**METAL SURVEY OF THE MARINE CLAM PITAR MORRHUANA COLLECTED NEAR A RHODE ISLAND (USA) ELECTROPLATING PLANT**, Environmental Research Lab., Narragansett, RI.

R. Eisler, M. M. Barry, R. L. Lapan, G. Telek, and G. W. Davey. Marine Biology, Vol 45, p 311-317, 1978. 4 fig, 3 tab, 8 ref.

Descriptors: \*Clams, \*Benthic fauna, \*Metals, \*Industrial wastes, \*Moisture content, \*Absorption, \*Water pollution sources, \*Path of pollutants, \*Cadmium, \*Cobalt, \*Chromium, \*Copper, \*Nickel, \*Lead, \*Zinc, Animal physiology, Food chains, Invertebrates, Mollusks, Shellfish, Benthos, Aquatic animals, Pitar morrhua, \*Narragansett Bay (Rhode Island), \*Electroplating.

Benthic fauna were collected from 17 stations in mid-Narragansett Bay, Rhode Island, during September 1973 from the vicinity of the recently-closed Quonset Point electroplating facility. Despite repeated sampling, most of the 14 species of molluscs taken, including the wideopen clam Pitar morrhua, were absent from stations in the immediate vicinity of plant outfalls. In general, P. morrhua captured near outfall sites exhibited high moisture content and elevated body burdens of silver, cadmium, cobalt, chromium, Copper, iron, manganese, nickel, lead, and zinc compared to clams of similar size from more distant stations. Observed changes in metal concentrations and moisture content of P. morrhua were probably attributable to plant operations during the preceding 30 years. (EIS-Katz)  
W78-12516

**EXCRETION RATE OF 65ZN: IS IT A USEFUL TOOL FOR ESTIMATING METABOLISM OF FISH IN THE FIELD**, National Marine Fisheries Service, Beaufort, NC.

Beaufort Lab. For primary bibliographic entry see Field 5C.  
W78-12521

**OCCURRENCE AND FATE OF ORGANIC AND INORGANIC CONTAMINANTS IN MARINE ANIMALS**, Torry Research Station, Aberdeen (Scotland).

K. J. Whittle, R. Hardy, A. V. Holden, R. Johnston, and R. J. Pentreath. Annals of the New York Academy of Sciences, Vol 298, p 47-79, 1977. 1 fig, 11 tab, 137 ref.

Descriptors: \*Organic compounds, \*Marine animals, \*Inorganic compounds, \*Chemicals, Water pollution sources, Water pollution effects, Path of pollutants, Chemical wastes, Absorption, Animal metabolism, Animal physiology, Biodegradation, Pesticides, Heavy metals, Radioisotopes, Biochemistry, Aromatic compounds, Industrial wastes, Fish physiology, Crustaceans, Bioaccumulation, Depuration.



Most chemical contaminants occur in highest concentrations in coastal waters often maximized in very localized areas. In general, this situation represents the exposure pattern for marine animals. However, the availability of a contaminant to an organism depends not only on its concentration but also on its chemical nature, its physical state, and whether the source of exposure is the surrounding seawater or the diet. Depending on the type of exposure, uptake occurs across absorptive surfaces, such as those of the respiratory apparatus or gastrointestinal tract, where selectivity may occur, even among neighboring homologs. Deposition in tissues, accumulation, degradation, or depuration depends on tissue type, metabolic processes, detoxification mechanisms, and the adaptive status of a particular animal. This hypothesis is examined briefly for hydrocarbons, pesticides, other miscellaneous organic contaminants, heavy metals, and radionuclides. It is concluded that most data relate to occurrence and distribution. Considerably less information is available on the underlying biochemical processes.

W78-12523

#### RIVER WATER QUALITY MODELLING: A COMBINED DETERMINISTIC-STOCHASTIC APPROACH.

Utah State Univ., Logan. Coll. of Engineering; and Utah Water Research Lab., Logan.

D. S. Bowles, and W. J. Grenney.  
In: Stochastic Processes in Water Resources Engineering, Proceedings, Second International IAHR Symposium on Stochastic Hydraulics, Lund Institute of Technology/University of Lund, Sweden, August 2-4, 1976. Lars Gottschalk, et al. (Eds.), Water Resources Publications, Fort Collins, Colorado, 1977, Chapter 25, p 515-546. 12 fig, 3 tab, 31 ref.

Stream assessment studies examine important physical processes controlling stream water quality, often by identifying diffuse and point sources of quality parameters, collecting hydraulic and stream quality data, and proposing a model of the stream processes and biochemical reactions. Typically, the model is deterministic and facilitates physical interpretation of stream processes. However, stochastic considerations of uncertainties associated with the model, the data, or the model responses are usually ignored, and it is difficult to determine when the deterministic model, or its inputs, adequately represent the system. In contrast, purely empirical stochastic models provide statistically efficient models, in which all uncertainties are lumped together, but a priori understanding of the physical processes is ignored. The extended Kalman filter can be used to provide minimum variance estimates of water quality parameters and confidence limits on the estimates. The technique uses all the available information: (1) a deterministic model of the physical processes; (2) measurements of water quality parameters; and (3) prior estimates of the system state (water quality parameters) and uncertainty. Sequential extended Kalman filters are proposed as a method for combining deterministic and stochastic approaches to steady-state river water quality modeling. An example of a preliminary application of the technique to the Jordan River, Utah, is provided using real data. In addition, sensitivity studies and coefficient estimation procedures are described. Model application to the Jordan River is in a preliminary stage, with refinements required in the uncertainty specifications. (Bell-Cornell)

W78-12532

#### CHOICE BETWEEN RIVER QUALITY MODELS OF DIFFERENT DEGREES OF COMPLEXITY.

Nuclear Research Center, Karlsruhe (West Germany). Div. of Applied Systems Analysis.

H. Stehfest.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium,

September 1978, convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No 125, p 3-13, 1978. 6 fig, 10 ref.

Descriptors: \*Water quality control, \*Dynamic programming, \*Streeter-Phelps model, \*Rivers, \*Ecological model, \*Cost minimization, Waste water treatment, Standards, Optimization, Simulation analysis, Pollutants, Biochemical oxygen demand, Oxygen, Measurement, Flow time, Mass concentration, Decision theoretical arguments, Steady state, Rhine River (West Germany), Equations, Model studies, Systems analysis.

Using an example, the problem of how to choose between river quality models of different degrees of complexity is investigated. This problem can be solved only in view of the management task the model is being used to accomplish. Therefore, two river quality models have been applied to a steady-state optimal control problem on the Rhine River in West Germany. One model is the Streeter-Phelps model, the other is an ecological model having six state variables. The optimal control problem consists of finding the least-cost distribution of waste water treatment effort in the region so that standards for oxygen and non-degradable pollution are met. Making use of the special structure of the problem, the solution is found via dynamic programming, even for the high-dimensional ecological model. The differences between the optimal solutions are remarkable, though not as large as one might expect from the differences in model structure. For selecting one of the two solutions for implementation, a formal procedure based on decision theoretical arguments is proposed to find the solution having the lowest expected costs. (Bell-Cornell)

W78-12533

#### SOME CRITERIA FOR SELECTION BETWEEN CORRECTION OF THE INDICATIVE FLOW AND THE WASTE TREATMENT EFFICIENCY IN A SMALL RIVER BASIN.

Institute of Meteorology and Water Management, Warsaw (Poland).

For primary bibliographic entry see Field 5D.

W78-12535

#### WATER QUALITY MODELLING IN SURFACE WATER NETWORKS WITH SPECIAL REGARD TO QUALITY BREAKDOWNS.

Institut fuer Wasserwirtschaft, Berlin (East Germany).

H. Baumert, and A. Becker.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No 125, p 269-276, 1978.

Descriptors: \*Surface waters, \*Networks, \*Water quality, \*Transverse mixing, \*Water resources models, \*Water quality models, \*Sewage, \*Simulation analysis, Decision making, Waste water (Pollution), Reach (Streams), Planning, Control, Optimum development plans, Computer programs, Dissolved oxygen, Real-time, Forecasting, Flowing waters, Quality breakdowns, Operations research.

If water quality models are to be used for decision making in water resources system planning and operation, in most cases they must be integrated in hierarchically-arranged comprehensive model systems. Applied principles used in the development of such model systems are summarized. A model for simulating quality breakdowns in water networks, considering the propagation of instantaneous sewage loads, and a model of transverse mixing of waste water in flowing waters are presented as examples of quality models. The latter was successfully tested in different river reaches within the German Democratic Republic.

Considered also is the position of water quality models within comprehensive water resources system (WRS) models. (Bell-Cornell)

W78-12537

#### COMPUTER PREDICTION OF THE CHANGES IN RIVER QUALITY REGIMES FOLLOWING LARGE SCALE INTER BASIN TRANSFERS.

Department of the Environment, Reading (England). Central Water Planning Unit.

A. B. Birtles, and S. R. A. Brown.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No 125, p 288-298, 1978. 11 fig, 2 tab, 7 ref.

Descriptors: \*Inter-basin transfers, \*Rivers, \*Water quality, \*Simulation analysis, Mathematical models, River flow, Synthetic hydrology, Systems analysis, Thames River (GB.), Data, Model performance, Chloride concentrations, Ortho-phosphate characteristics, Prediction.

Of the alternative proposed water resource development schemes to meet future demands in the southeastern part of England, one contender is a strategy to transfer water from the River Severn to the River Thames at appropriate times. Severn flows would be augmented when necessary from surface storages in Wales. Simulation experiments have been performed to estimate the water quality effects of inter-basin transfers on the recipient system. A range of nearly conservative river quality determinands has been investigated using river quality models. Examples of the results obtained are presented in a form which facilitates estimating (1) the size and cost of any treatment plant which may be necessary to make transferred water compatible with receiving waters, and (2) the adverse effects of transfers on organisms with known concentration tolerance levels. The production of long simulated concentration sequences is not in itself particularly useful, because the great volume of data generated is not readily susceptible to manual interpretation; there is a clear requirement for some kind of condensation which will allow the essential characteristics of the data to be presented in a concise form that enables, say, conformity with suitable defined standards or criteria to be judged quickly and accurately. (Bell-Cornell)

W78-12539

#### WATER QUALITY MODELLING AS A TOOL FOR DECISION MAKING IN HUNGARY.

Research Inst. for Water Resources Development, Budapest (Hungary).

For primary bibliographic entry see Field 5G.

W78-12541

#### ASSESSMENT TECHNIQUES FOR MODELLING WATER QUALITY IN A RIVER BASIN IMPACTED BY COAL RESOURCE DEVELOPMENT.

Geological Survey, Denver, CO.

T. D. Steele.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No. 125, p 322-332, 1978. 6 fig, 1 tab, 22 ref.

Descriptors: \*Assessment, \*Water quality control, \*River basins, \*Environmental effects, \*Coal resource development, Evaluation, Water pollution, Reach (Streams), Reservoirs, Yampa River (Col. and Wyoming), Mathematical models, Systems analysis, Wastes, Travel times, High flow, Low flow, Dissolved solids, Simulation analysis, Regional analysis.

### Group 5B—Sources Of Pollution

**TOXIC POLLUTANTS CONTROL: PROGRESS AT LAST,**  
For primary bibliographic entry see Field 5G.  
W78-12567

Land disposal of municipal sludge is a practice utilized for many years, but only recently is it being considered on a large scale. A potential problem is the physical clogging of the soil pores after extended sludge application. Movements of two water suspensions, kaolinite clay and sewage sludge into two sand-silt mixtures were studied by dual-energy gamma-ray attenuation. Equations were developed to describe the increase of suspension-particle bulk density at a given position in the sand-silt column and also the reduction in hydraulic conductivity with cumulative volume of outflow from the column. The capability of these equations for describing the observed experimental results was tested by nonlinear least squares regression. An exponential increase of suspension-particle density with time was found to describe the experimental results very well qualitatively. A slightly better quantitative fit was obtained with a logarithmic equation, but the exponential equation was preferred in an overall sense. The reduction in hydraulic conductivity was described very well by an exponential function of cumulative volume of outflow. A constant in this function, termed the

**EFFECT OF PH ON THE ADSORPTION OF TRACE RADIOACTIVE CESIUM BY SEDIMENTS,**  
King Faisal Univ., Dammam (Saudi Arabia). Dept. of Soils and Water, and Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy. A. M. Elprince.  
Water Resources Research, Vol 14, No 4, p 696-698, August 1978. 1 fig, 1 tab, 12 ref. ERDA E(40-1)-4851.

Descriptors: \*Hydrogen ion concentration, \*Cesium, \*Adsorption, \*Sediments, Trace elements, Radioactive wastes, Radioactivity, Model studies, Mathematical models, Sampling, Surveys, Laboratory tests, Water pollution, Streams, Rivers.

The adsorption of trace radioactive cesium by sediments from the Savannah River Plant area follows a theoretically expected linear relationship between  $\ln K_d$  and the pH of the equilibrium solution, where  $K_d$  is the equilibrium distribution coefficient:  $C_s$  adsorbed (meq/g)/ $C_s$  (+) in solution (meq/ml). Theoretically the slope of these plots is proportional to the fraction of surface area occupied by pH dependent charges. Experimentally, the slope becomes 0 after removal of hydroxy Al interlayers with citrate pretreatment. Thus, hydroxy Al interlayers are the main source for the pH dependent charges making  $C_s$  adsorption pH dependent. (Sims-ISWS)  
W78-12635

**HISTORICAL AND CURRENT HEAVY METAL RESIDUES IN HUDSON RIVER FISH,**  
Marist Coll., Poughkeepsie, NY. Research Inst. R. E. Rehboldt, W. Mastrianni, E. Kelley, and J. Stall.  
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 3, p 335-339, 1978. 2 tab, 9 ref.

Descriptors: \*Cadmium, \*Lead, \*Mercury, \*Heavy metals, \*Absorption, Animal behavior, Animal metabolism, Fish physiology, \*Industrial wastes, \*Sediments, \*Food habits, \*Predation, \*Food chains, Sampling, Path of pollutants, Metals, Toxicity, Freshwater fish, \*Hudson River(NY), New York, Tissue analysis, Bioaccumulation.

This investigation deals with fish taken from the Hudson River during 1976 and 1977 and samples from the same water system originally captured in a time period ranging from 1934 to 1973. The data on tissue content of cadmium, mercury and lead did not follow any chronological relationship. The only pattern that emerged was a relationship between feeding behavior and heavy metal content. Predatory fish had a higher mercury content. Cadmium and lead appeared to be independent of feeding habits. (EIS-Deal)  
W78-12671

**MICROBIAL ECOLOGY STUDIES OF METULA SPILL IN THE STRAITS OF MAGELLAN,**  
Maryland Univ., College Park. Dept. of Microbiology.  
For primary bibliographic entry see Field 5C.  
W78-12673

**BIOAVAILABILITY OF CRUDE OIL FROM EXPERIMENTALLY OILED SEDIMENTS TO ENGLISH SOLE (PAROPHYRUS VETULUS), AND PATHOLOGICAL CONSEQUENCES,**  
National Marine Fisheries Service, Seattle, WA. Environmental Conservation Div.

B. B. McCain, H. O. Hodgins, W. D. Gronlund, J. W. Hawkes, and D. W. Brown.  
Journal of the Fisheries Research Board of Canada, Vol. 35, p 657-664, 1978. 5 fig, 1 tab, 28 ref.

Descriptors: \*Oil, Fish physiology, \*Bottom sediments, Animal pathology, \*Aromatic compounds, \*Enzymes, Oil pollution, Oil spills, Sediments, Path of pollutants, Water pollution effects, Animal metabolism, Organic compounds, Pathology, \*Depuration, Liver, \*Crude oil, Tissue analysis, Bioaccumulation, \*Bioavailability, \*Sole, \*Naphthalenes, \*Flatfish, Parophrys.

English sole were exposed to experimentally oiled sediments over a 4-mo period to assess the bioavailability and tissue hydrocarbon distribution

kinetics in flatfish. Data were also obtained on hydrocarbon-related physiological changes and tissue pathology. Crude oil was mixed with aromatic hydrocarbon-free sediments to a concentration of 700 micrograms/g dry weight at the beginning of the experiment. During the 1st mo of the experiment this concentration decreased to 400 micrograms/g dry weight, and remained relatively stable during the remainder of the 4-mo period. Compositional changes were observed in the alkane and aromatic fractions, with a differential decrease in the substituted naphthalenes. Flatfish maintained in such oiled sediments readily took up alkane and aromatic petroleum hydrocarbons from these sediments, and accumulated these in skin, muscle, and liver. 1- and 2-methylnaphthalene and 1,2,3,4-tetramethylbenzene were accumulated to greater extent than other aromatics. Observations on growth changes and liver pathology indicate the need for further detailed study of fish growth abnormalities and pathology in the presence of petroleum hydrocarbons. (EIS-Deal)  
W78-12674

**DISTRIBUTION AND TOXICITY OF SELECTED WATER POLLUTANTS IN THE SPINY DOGFISH, SQUALUS ACANTHIAS,**  
National Cancer Inst., Bethesda, MD.  
For primary bibliographic entry see Field 5C.  
W78-12677

**FATE OF POLYCYCLIC AROMATIC HYDROCARBONS IN CONTROLLED ECOSYSTEM ENCLOSURES,**  
Skidway Inst. of Oceanography Savannah, GA. R. F. Lee, W. S. Gardner, J. W. Anderson, J. W. Blaylocke, and J. Barwell-Clarke.  
Environmental Science and Technology, Vol. 12, No. 7, p 832-838, 1978. 6 fig, 4 tab, 34 ref.

Descriptors: \*Oil pollution, \*Oil, \*Aromatic compounds, Oil spills, Organic compounds, Water analysis, Zooplankton, Oysters, Bottom sediments, Microbial degradation, Biodegradation, Oxidation, Chemical analysis, \*Crude oil, \*Naphthalenes.

Prudhoe crude oil enriched with a number of polycyclic aromatic hydrocarbons was added as a dispersion to a controlled ecosystem enclosure suspended in Saanich Inlet, Canada. Concentrations of various aromatics were determined in water, zooplankton, oysters, and bottom sediments. These concentrations decreased at an exponential rate due to evaporation, photochemical oxidation, microbial degradation, and sedimentation. Only naphthalenes were significantly degraded by microbes with removal by this process of up to 5% per day from the water. Sedimentation and photochemical oxidation were responsible for the decrease in concentrations of the higher weight aromatics. (EIS-Katz)  
W78-12678

**RELATIONSHIPS BETWEEN SOIL SALINITY AND THE SALINITY OF APPLIED WATER IN THE SUISUN MARSH OF CALIFORNIA,**  
California State Dept. of Fish and Game, Sacramento. Wildlife Management Branch.  
For primary bibliographic entry see Field 2G.  
W78-12692

**TEN-YEAR LOW MEAN MONTHLY DISCHARGE DETERMINATIONS FOR UNGAGED STREAMS NEAR WASTE-STABILIZATION PONDS IN WISCONSIN,**  
Geological Survey, Madison, WI. Water Resources Div.  
For primary bibliographic entry see Field 5G.  
W78-12723

**USE OF LABORATORY DATA TO PREDICT SULFATE SORPTION DURING ARTIFICIAL GROUND-WATER RECHARGE,**  
Geological Survey, Reston, VA. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W78-12724

**UNSTEADY SOLUTE-TRANSPORT SIMULATION IN STREAMFLOW USING A FINITE-DIFFERENCE MODEL,**  
Geological Survey, Bay St. Louis, MS. Water Resources Div.  
L. F. Land.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 264, Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 78-18, May 1978. 54 p, 4 fig, 6 ref.

Descriptors: \*Ion transport, \*Solutes, \*Unsteady flow, \*Model studies, \*Computer models, Analytical techniques, Streamflow, Water quality, \*Solute-transport simulation.

This report documents a rather simple, general purpose, one-dimensional, one-parameter, mass-transport model for field use. The model assumes a well-mixed conservative solute that may be coming from an unsteady source and is moving in unsteady streamflow. The quantity of solute being transported is in the units of concentration. Results are reported as such. An implicit finite-difference technique is used to solve the mass transport equation. It consists of creating a tridiagonal matrix and using the Thomas algorithm to solve the matrix for the unknown concentrations at the new time step. The computer program presented is designed to compute the concentration of a water-quality constituent at any point and at any preselected time in a one-dimensional stream. The model is driven by the inflowing concentration of solute at the upstream boundary and is influenced by the solute entering the stream from tributaries and lateral ground-water inflow and from a source or sink. (Woodard-USGS)  
W78-12726

**STREAM QUALITY IN THE SAN LORENZO RIVER BASIN, SANTA CRUZ COUNTY, CALIFORNIA,**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
M. A. Sylvester, and K. J. Covay.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 288, Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 78-19, April 1978. 61 p, 12 fig, 8 tab, 30 ref.

Descriptors: \*Water quality, \*Streams, \*Water pollution sources, \*Septic tanks, Domestic wastes, Coliforms, Bacteria, Land use, Runoff, Streamflow, Water analysis, Benthic fauna, \*California, \*San Lorenzo River basin(Calif), Santa Cruz County(Calif).

Stream quality was studied from November 1973 through June 1975 in the San Lorenzo River basin, Calif., a rapidly developing mountainous area. Dissolved-ion concentrations indicate the basin can be divided into three water-quality areas corresponding to three geologic areas. Pronounced changes in water quality occurred during storms when streamflow, turbidity, nitrogen, phosphorus, potassium, and fecal-coliform bacteria concentrations increased, while dissolved-ion concentrations decreased owing to dilution. Total nitrogen and fecal-coliform concentrations exceeded State objectives in the Zayante and Branciforte Creek drainages probably because of domestic sewage from improperly operating septic-tank systems or the primary-treated sewage effluent discharged into a pit near Scotts Valley. Diel studies did not show appreciable dissolved-oxygen depletion in streams. Greater streamflows and residential



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

development appear responsible for reduced diversity of benthic invertebrates downstream of the residential areas in the basin. (Woodard-USGS)  
W78-12734

**AN EVALUATION OF PROBLEMS ARISING FROM ACID MINE DRAINAGE IN THE VICINITY OF SHASTA LAKE, SHASTA COUNTY, CALIFORNIA,**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 5G.  
W78-12735

**WATER-QUALITY INVESTIGATION, UPPER SANTA CLARA RIVER BASIN, CALIFORNIA,**  
Geological Survey, Menlo Park, CA. Water Resources Div. and Geological Survey, Tallahassee, FL. Water Resources Div.  
J. C. Bowers, and G. A. Irwin.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 289, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 77-99, March 1978. 43 p, 1 fig, 11 tab, 10 ref.

Descriptors: \*Water quality, \*Path of pollutants, \*Streams, \*California, \*Water analysis, Trace elements, Nitrogen, Phosphorus, Nutrients, Pesticides, Carbon, Detergents, Bottom sampling, Streamflow, Flow rates, Specific conductivity, Data collections, \*Upper Santa Clara River basin(Calif).

Water-quality data are summarized for the upper Santa Clara River basin, California from studies beginning August 1974 through June 1976 and during past monitoring programs. Data were collected for nitrogen, phosphorus, total organic carbon, trace elements, detergents, and pesticide compounds. Because of the limited number of samples, the data are only an estimate of conditions that existed in the basin. Sampling was designed so that samples from each site would represent seasonal variations in discharge. Most constituents were fairly low in concentration near the headwaters at Ravenna and higher below the urban and agricultural area near Saugus. Mean specific conductance in the river ranged from 745 micromhos per centimeter at 25 deg C below the headwaters near Lang to 2,640 micromhos at the Los Angeles-Ventura County line. Results also indicate that discharge was not the single factor controlling the concentration variance for most constituents. Regression analyses indicated a high correlation between specific conductance and most major inorganic chemical constituents, and between specific conductance and discharge. (Woodard-USGS)  
W78-12737

**INTERIM REPORT ON STREAMFLOW, SEDIMENT DISCHARGE, AND WATER QUALITY IN THE CALABAZAS CREEK BASIN, SANTA CLARA COUNTY, CALIFORNIA,**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 4D.  
W78-12738

**PROGRESS REPORT ON BLACK MESA PROGRAM--1977.**  
Geological Survey, Tucson, AZ. Water Resources Div.  
For primary bibliographic entry see Field 5G.  
W78-12740

**PHOSPHORUS SOURCE MANAGEMENT FOR EUTROPHIC LAKES. PHASE I: TRIBUTARY PHOSPHORUS LOADING,**  
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology; and Rutgers - The State Univ.,

New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.  
F. B. Trama, and R. C. Ahlert.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 315, Price codes: A05 in paper copy, A01 in microfiche. A Completion Report by the Water Resources Research Institute, Rutgers University, September, 1978. 69 p, 11 fig, 11 tab, 34 ref, 2 append. OWRT A-047-NJ(5), 14-34-0001-7064.

Descriptors: Streams, \*Storm runoff, \*Phosphates, \*Eutrophication, Reservoirs, Nutrients, \*Phosphorus loading, \*Waste loading, \*Eutrophic lakes, Management, Water pollution, \*New Jersey, Water quality, Data collections, Urban runoff, Non-point pollution sources, Storm flows.

Contribution of phosphorus during base and storm flows was studied on several New Jersey streams. Phosphorus concentrations were very stable in the absence of point sources and major disturbances. Large changes in concentration occurred with storm flows greater than 1000 l/s, and the dissolved phosphorus fraction usually increased during peak flow unless the major rainfall was a good distance upstream from the sampling site. Storms contributed from 50 to 75% of the true annual phosphorus load and a sizeable portion of this storm-related load was attributable to a few major storms during the year. Most of the storm-related phosphorus was associated with particulate matter. It was possible to predict storm phosphorus loads with a high degree of accuracy from a knowledge of the storm hydrograph and the stream's storm loading coefficient. Existing water quality data and flow records for Stony Brook and Millstone River above Lake Carnegie were examined in an attempt to calculate total annual phosphorus loading from point and non-point sources.  
W78-12746

**QUALITY AND QUANTITY OF STORM-WATER RUNOFF FROM THREE LAND-USE AREAS, BROWARD COUNTY, FLORIDA,**  
Geological Survey, Miami, FL. Water Resources Div.  
H. C. Matraw, Jr.  
In: Proceedings of the International Symposium on Urban Storm-Water Management, University of Kentucky, Lexington, July 24-27, 1978. 5 p, 5 fig, 1 tab, 6 ref.

Descriptors: \*Storm runoff, \*Urban runoff, \*Storm water, \*Water quality, \*Rainfall-runoff relationships, Urban hydrology, Data collections, Hydrologic data, Evaluation, Land use, Florida, \*Broward County(Fla).

The U.S. Geological Survey has measured rainfall, runoff and runoff quality from storms for three urban sewer basins in Broward County, Fla. Approximately 2 years of records have been collected for a 47-acre single-family residential area; a 58-acre, 3,000 foot secondary divided-highway segment; and a 28-acre commercial shopping center. Approximately 100 rainfall-runoff periods per site were digitized from analog records and stored in an urban data management system. Sets of nutrient and heavy-metal water-quality data were collected for 30 or more storms at each of the three areas and stored in the system. Loads computed for the three areas indicate the importance of the hydraulic interconnection between impervious areas. Factors which affect storm-water runoff loads include land use, proportion of hydraulically interconnected impervious area, seasonal distribution of rainfall, and the antecedent dry period. (Woodard-USGS)  
W78-12748

**THE FREQUENCY, DISTRIBUTION, AND PATHOLOGY OF THREE DISEASES OF DEMERSAL FISHES IN THE BERING SEA,**  
National Marine Fisheries Service, Seattle, WA. Northwest Fisheries Center.  
For primary bibliographic entry see Field 5C.  
W78-12751

**APPARATUS TO DETECT TOXIC IONS IN THE ATMOSPHERE OR DISSOLVED IN WATER,**  
Ministere des Armees, Paris (France). Delegation Ministerielle pour l'Armement.  
For primary bibliographic entry see Field 5A.  
W78-12798

**LEAD AND COPPER IN THE WATERS OF RARITAN AND LOWER NEW YORK BAYS,**  
National Marine Fisheries Service, Highlands, NJ. Middle Atlantic Coastal Fisheries Center.  
R. Waldhauer, A. Matte, and R. E. Tucker.  
Marine Pollution Bulletin, Vol. 9, No. 2, p 38-42, February 1978. 2 fig, 1 tab, 34 ref.

Descriptors: \*Water pollution effects, \*Environmental effects, \*Metals, New York, Lead, Copper, Industrial wastes, Resources development, \*Outer Continental Shelf.

A survey of waters adjacent to this heavily urbanized and industrialized region showed concentrations of copper, to be the highest reported to date for estuarine waters. Correlations between distributions of dissolved and total metal concentration in the water column, hydrography, and metal in the sediment were related to benthic studies in this area. Laboratory studies are cited which show the potential for adverse effects on marine animals at these metal concentrations. (Sinha-OEIS)  
W78-12811

**SERIOUS MERCURY CONTAMINATION OF SEDIMENTS IN A NORWEGIAN SEMI-ENCLOSED BAY,**  
Norwegian Inst. for Water Research, Oslo (Norway).  
J. M. Skei.  
Marine Pollution Bulletin, Vol 9, No 7, p 191-193, July 1978. 1 fig, 1 tab, 25 ref.

Descriptors: \*Sediments, \*Mercury, \*Water pollution sources, Water pollution effects, Environmental effects, Benthos, Industrial wastes, \*Outer Continental Shelf, Norway.

Thirteen surface sediment samples from a shallow, semi-enclosed bay, Gunnekleivfjorden, South-West Norway, were analysed for total mercury. The concentrations ranged between 90 and 350 ppm dried sediment. The median value (250 ppm mercury) is more than twice the median value of sixteen sediment samples collected in Minamata Bay in 1963. The surface area of Gunnekleivfjorden is approximately 1 sq km, implying that minimum 10 tons of mercury is accumulated in the upper 5 cm of the sediments of the bay. The extensive contamination is caused by discharge of inorganic mercury from a chlor-alkali plant during the last 25 years. (Sinha-OEIS)  
W78-12815

**A CONCEPTUAL MODEL FOR RESPONSE TO ARCTIC OIL SPILLS,**  
Coast Guard Research and Development Center, Groton, CT.  
I. M. Lissauer, and D. L. Murphy.  
Environmental Management, Vol 2, No 4, p 341-346, July 1978. 3 fig. 6 ref.

Descriptors: \*Oil spills, \*Polar regions, \*Water pollution control, \*Arctic, Baseline studies, Environmental effects, Resources development, Planning, \*Model studies, \*Outer Continental Shelf, Petroleum resources.

The potential increased significance of petroleum in the Arctic is the temperature of the area and unique problems and subsequent cleanup program to the Arctic. The polar ice dynamics new model design developing a spill. (Sinha-W78-12818)

**NATURAL LIMNOLOGICAL VERTICAL SEE,**  
Edigenoessi (Switzerland). D. M. Imboden. Limnology 77-90, January

Descriptors: \*Radioisotopes, \*Oceanography, On-site, Theoretical, temperature, Eddy diffusion

Two-dimensional measurements in hypolimnetic regions in 1975. A three-dimensional to the data for the diffusion coefficient information related to solved problems. The eddy good agreement predicted by applied to pl from the eutrophic external internal photosynthesis  
W78-12849

**VARIABLE SEDIMENT OKLAHOMA**  
Agricultural Quality M For primary  
W78-12853

**AN ATTEMPT AT A STATE AMOUNT**  
Illinois U gy, Ethol Urban-dies. W. P. Lov Journal of 964-975, 3

Descriptor: \*Industri Synoptic Air pollu effects, I gy, \*Hun

The potential for oil spills in Arctic regions has increased significantly because of the development of petroleum resources. Response to an oil spill in the Arctic is likely to be much slower than that in the temperate region because of the remoteness of the area and its severe climate. In the face of these unique problems, accurate prediction of the extent and subsequent movement of an oil spill is vital to any cleanup effort. Presented is the framework of a program to study the movement of oil spills in the Arctic. Existing models of oil spreading and polar ice dynamics are reviewed and areas where new model development is required are defined. A system design is developed that may be used for developing a plan to act in the event of a major spill. (Sinha-OEIS)  
W78-12818

**NATURAL RADON AND PHOSPHORUS AS LIMNOLOGIC TRACERS: HORIZONTAL AND VERTICAL EDDY DIFFUSION IN GREIFENSEE.**  
Eidgenössische Technische Hochschule, Zurich (Switzerland).  
D. M. Imboden, and S. Emerson.  
Limnology and Oceanography, Vol. 23, No. 1, p 77-90, January 1978. 7 fig, 5 tab, 22 ref.

Descriptors: \*Tracers, \*Phosphorus, \*Radioisotopes, \*Diffusion, Lakes, Water circulation, On-site data collections, Data processing, Theoretical analysis, Eddies, Temperature, Water temperature, Sediments, Limnology, \*Radon, Eddy diffusion.

Two-dimensional interpretation of monthly measurements of natural radon-222 at different stations in Greifensee, Switzerland, results in hypolimnetic vertical and horizontal eddy diffusion coefficients ( $K$  sub  $z$  and  $K$  sub  $x$ ) of 0.2-0.05 and 1,000-100 sq cm/s during the stagnation period in 1975. Application of the one-dimensional and three-dimensional horizontally well mixed models to the data from the midlake station produces errors of about a factor of two in the vertical eddy diffusion coefficient. With the hypolimnetic mixing information,  $K$  sub  $z$  in the thermocline is estimated to be 0.025 + or - 0.015 sq cm/s by using dissolved phosphorus as a quasi-conservative tracer. The eddy diffusion coefficients calculated are in good agreement with those which would be predicted by empirical methods. The results when applied to phosphorus cycling indicate that P reflux from the hypolimnion and thermocline in eutrophic Greifensee is of the same magnitude as external inputs during the months of maximum photosynthesis. (Sims-ISWS)  
W78-12849

**VARIABILITY OF ANNUAL NUTRIENT AND SEDIMENT DISCHARGES IN RUNOFF FROM OKLAHOMA CROPLAND AND RANGELAND.**  
Agricultural Research Service, Durant, OK. Water Quality Management Lab.  
For primary bibliographic entry see Field 5G.  
W78-12858

**AN ATTEMPT TO DETECT THE EFFECTS OF A STEELWORKS ON PRECIPITATION AMOUNTS IN CENTRAL HUNGARY.**  
Illinois Univ., Urbana-Champaign, Dept. of Ecology, Ethology, and Evolution; and Illinois Univ., Urbana-Champaign, Inst. for Environmental Studies.  
W. P. Lowry, and F. Probal.  
Journal of Applied Meteorology, Vol. 17, No. 7, p 964-975, July 1978. 4 fig, 4 tab, 15 ref, 2 append.

Descriptors: \*Precipitation (Atmospheric), \*Industries, \*Effects, \*Analytical techniques, Synoptic analysis, Statistics, Statistical methods, Air pollution, Air pollution effects, Environmental effects, Data processing, Climatology, Meteorology, \*Hungary, Steelworks.

Daily precipitation amounts from a 20-station network within 50 km of a major steelworks at Dunaujvaros were analyzed in two ways for a decade preceding construction of the works in the late 1950's and a decade immediately following. The 'classical' method was by examination of isohyets of precipitation totals. The second method employed statistical testing of stratified inter-decadal differences at each station using Student's test. Stratification are by season (June and December) and by synoptic weather types. Post-industrial maps showing isohyets of mean monthly totals for June and for December both exhibited relative maxima to the northeast and the southeast of the steelworks at distances between 40 and 55 km. Aggregation of inter-decadal differences across synoptic types and seasons exhibited greater numbers of 'large' values of  $t$ , both positive and negative, than would be expected by chance. These two results by themselves suggest that an effect on precipitation due to the steelworks has been detected. The pre-industrial isohyetal map of monthly totals for June exhibits a distinctive maximum 50 km to the northeast of the steelworks, and post-industrial isohyetal maps for individual synoptic types showed no spatially coherent maxima or minima 'downwind' of the steelworks. Within synoptic types, inter-decadal differences considered statistically 'large' were neither spatially coherent in general nor of consistent sign between seasons in the single type having several large differences in both seasons. It was concluded, on balance, that no effect due to the steelworks has been detected, and then the implications of that conclusion were examined. It also was argued that this comparison of methods of analysis points up the need for both synoptic stratification and the statistical testing of temporal differences in attempts to detect anthropogenic effects on precipitation amount using standard climatological data. (Sims-ISWS)  
W78-12860

**CONCENTRATIONS OF HEAVY METALS IN SMALL NORWEGIAN LAKES.**  
Norsk Inst. for Vannforskning, Blindern.  
A. Henriksen, and R. F. Wright.  
Water Research, Vol. 12, No. 2, p 101-112, 1978. 7 fig, 4 tab, 27 ref.

Descriptors: \*Heavy metals, \*Water quality, \*Water pollution, \*Lead, \*Cadmium, Water pollution sources, Analytical methods, Metals, Zinc, Public health, Toxicity, Pollutants, Copper, Chemical analysis, Copper compounds, Toxins, Lakes, \*Norway, \*Scandinavia.

As part of regional surveys of lakes in Norway, the concentrations of Zn, Pb, Cu, and Cd were measured in surface- and bottom-water samples collected from representative, small, pristine lakes (136 in southern Norway sampled in October 1974, 58 resampled in March 1975, and 77 in northern Norway sampled in March 1975). The lakes, a statistically representative sample of small lakes in Norway, were chosen because their watersheds are undisturbed. Thus, heavy metal concentrations in these lakes reflect only natural inputs and anthropogenic inputs via the atmosphere. The generally low concentrations (Zn 0.5-12.0 micrograms/L; Pb 0-2.0 micrograms/L; Cu 0-2.0 micrograms/L; Cd 0.1-0.5 micrograms/L) measured in lakes in central and northern Norway provide estimates of natural 'background' levels. These estimates may be too high because they include the global-scale deposition of heavy metals from the atmosphere which has increased as a result of industrial activities. Concentrations of Zn and Pb in lakes in southernmost and southeastern Norway lie above these 'background' levels, apparently because of atmospheric deposition associated with the precipitation that falls over southern Scandinavia. Increased heavy metal concentrations in acid lakes also may be due to increased mobilization of metals due to acidification of soil- and surface-waters. (Henley-ISWS)  
W78-12861

**MICROBIOLOGICAL STUDIES ON THE NITROGEN CYCLE IN AQUATIC ENVIRONMENTS -- IV, METABOLIC RATE OF AMMONIUM NITROGEN IN FRESHWATER REGIONS.**  
Kyoto Inst. of Oceanic and Fishery Science (Japan).  
For primary bibliographic entry see Field 5C.  
W78-12867

**FURTHER STUDIES OF PLANKTON ECOSYSTEMS IN THE EASTERN INDIAN OCEAN VIII. SEASONAL, DIURNAL, AND LATITUDINAL VARIATIONS IN ABUNDANCE OF EUTHECOSOMATA ALONG THE 110 DEGREE E. MERIDIAN.**  
Marine Products Export Development Authority, Calcutta (India).  
For primary bibliographic entry see Field 5C.  
W78-12869

**STUDIES ON COPPER METABOLISM IN FISHES--II. THE SITE OF COPPER ACCUMULATION IN THE TISSUES OF CARP (IN JAPANESE).**  
Kyoto Univ. (Japan). Dept. of Fisheries.  
For primary bibliographic entry see Field 5C.  
W78-12870

**DENITRIFICATION OF AMMONIA FORMATION IN ANAEROBIC COASTAL SEDIMENTS.**  
Tokyo Univ. (Japan). Ocean Research Inst.  
For primary bibliographic entry see Field 5C.  
W78-12885

**THE DISTRIBUTION OF NUTRIENTS IN SWARTVLEI, A SOUTHERN CAPE COASTAL LAKE.**  
Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.  
C. H. Williams.  
Water SA, Vol. 3, No. 4, p 213-217, October 1977. 2 fig, 3 tab, 21 ref.

Descriptors: \*Nutrients, \*Swartvlei (South Africa), \*Macrophytes, \*Saline lakes, \*Littoral, \*Sediments, \*Distribution, Oligotrophy, South Africa, Lakes, Nitrogen, Phosphorus, Coasts, Potamogeton pectinatus, Chara globularis var. Kraussii, Lamprothamnium papulosum.

Nitrogen and phosphorus values are given for macrophytes, sediments, and water of Swartvlei, an unpolluted coastal lake on South Africa's Coastal Cape which despite its oligotrophic status supports a large aquatic macrophyte community. Very high community metabolic rates in the littoral, combined with large nutrient stocks bound up there, suggest that the littoral has an important influence on the lake's nutrient dynamics. In Swartvlei by far the largest standing stocks of both nitrogen and phosphorus were found in the sediments, followed by macrophytes. In waters, there was a large difference between soluble reactive phosphorus (phosphate-phosphorus) and total soluble phosphorus, and P-32 orthophosphate is strongly bound by humic materials. More specifically, the phosphorus appears bound to humic chelate complexes of iron and aluminum, indicating humic matter may play a significant role in the phosphorus cycle. All but one of the coastal lakes are connected to the sea, directly in the case of Swartvlei. Most are oligotrophic, and all have large macrophyte communities. Salinity varies 4-20‰. The submerged plant community consists primarily of Potamogeton pectinatus, Chara globularis var. kraussii, and Lamprothamnium papulosum. In Swartvlei 30% of the lake area is occupied by macrophytes. Bottom waters are anaerobic, with hydrogen sulfide present much of the year, resulting in phosphate-phosphorus releases into the water. (Lynch-Wisconsin)  
W78-12889

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

**NORTH AMERICAN PROJECT—A STUDY OF U.S. WATER BODIES.**  
Corvallis Environmental Research Lab., OR.  
For primary bibliographic entry see Field 5C.  
W78-12895

**PLUTONIUM UPTAKE BY PLANTS FROM SOIL CONTAINING PLUTONIUM-238 DIOXIDE PARTICLES,**  
Environmental Monitoring and Support Lab., Las Vegas, NV.  
K. W. Brown, and J. C. McFarlane.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 000.  
Price codes: A02 in paper copy, A01 in microfiche.  
Publication No. EPA-600/3-77-052, May, 1977. 13 p, 3 fig, 2 tab, 21 ref.

**Descriptors:** Alfalfa, Vegetables, Crop production, Soil investigations, \*Plutonium-238, Soil chemistry, \*Radioisotopes, Water pollution sources.

Three plant species—alfalfa, lettuce, and radishes—were grown in soils contaminated with plutonium-238 dioxide ( $^{238}\text{PuO}_2$ ) at concentrations of 23, 69, 92, and 342 nanocuries per gram (nCi/g). The length of exposure varied from 60 days for the lettuce and radishes to 358 days for the alfalfa. The magnitude of plutonium incorporation as indicated by the discrimination ratios for these species, after being exposed to the relatively insoluble  $\text{PuO}_2$ , was similar to previously reported data using different chemical forms of plutonium. Evidence indicates that the predominant factor in plutonium uptake by plants may involve the chelation of plutonium contained in the soils by the action of compounds such as citric acid and/or other similar chelating agents released from the plant roots. (Skogerboe-Colorado State)  
W78-12938

**EVALUATION OF THE MAGNITUDE AND SIGNIFICANCE OF POLLUTION FROM URBAN STORM WATER RUNOFF IN ONTARIO,**  
American Public Works Association, Chicago, IL; and Florida Univ., Gainesville.  
R. H. Sullivan, W. D. Hurst, T. M. Kipp, J. P. Heaney, and W. C. Huber.  
Canada-Ontario Agreement on Great Lakes Water Quality, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada; Pollution Control Branch, Ontario Ministry of Environment, Toronto, Ontario, Canada, Research Report No. 81, 183 p, 34 fig, 65 ref, 51 tab, 4 append. 74-8-21.

**Descriptors:** \*Storm water, \*Storm runoff, \*Pollution control, \*Water pollution, Urban runoff, Sewerage, Land use, Human population, Biochemical oxygen demand, Methodology, Costs, Data collections, \*Canada, \*Ontario, Burlington, Guelph, Kingston, Kitchener, Milton, St. Catharines, Sault Ste Marie, Wet-weather flows, Dry-weather flows, Pollution loadings.

An assessment has been made of the magnitude and significance of the pollution loadings from urban runoff in the province of Ontario. The study was conducted under the provisions of the Canada-Ontario and Canada-United States Agreement on Great Lakes Water Quality. The selected local authorities were interviewed to obtain detailed local data. In addition, various maps and demographic information were supplied by the Ministry of the Environment. Methodology used by the American Public Works Association and the University of Florida for a study of similar problems in the United States provided a basis for data manipulation and preparation of cost estimates, modified where possible to reflect conditions relevant to Ontario. The cost estimate performed indicated that to obtain 25 percent control of BOD, an annual cost of \$10,861,000 would be incurred. These costs are exclusive of the storm flow conveyance system. For BOD control at 75

percent, the annual cost would be \$95,471,000. (WATDOC)  
W78-12946

**A MODEL SYSTEM TO STUDY THE DESORPTION AND BIOLOGICAL AVAILABILITY OF PCB IN HYDROSOILS,**  
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.  
M. T. Halter, and H. E. Johnson.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F. L. Mayer and J. L. Hamelink, eds., American Society for Testing and Materials, p 178-195, 1977. 6 fig, 4 tab, 45 ref.

**Descriptors:** \*Polychlorinated biphenyls, \*Minnows, \*Hydrosols(Soils), Aroclors, Chlorinated hydrocarbons pesticides, Testing procedures, Testing, Analytical techniques, Absorption, Chlorine, Pesticide kinetics, Chemical analysis, Bioassay, Bioaccumulation, Tissue analysis.

Model aquatic systems incorporating hydrosol, water, and fish components were used to measure the dynamics of Aroclor-1254 under both flowing and static water conditions. PCB desorption from hydrosols was consistent with adsorption-desorption theory. Equilibrium PCB concentrations in water could be predicted under both static and continuous flow conditions with the distribution coefficient equation. Desorption favored the lower-chlorinated, more water-soluble components of Aroclor 1254. Fathead minnows allowed direct contact with PCB-contaminated hydrosols accumulated PCB residues at six times the rates of those screened from direct exposure to sediments. Fish selectively bioaccumulated the higher chlorinated components of Aroclor 1254. (See also W78-06608) (EIS-Deal)  
W78-12980

**APPLICATION OF AN EVAPORATIVE LOSS MODEL TO ESTIMATE THE PERSISTENCE OF CONTAMINANTS IN LENTIC ENVIRONMENTS,**  
Purdue Univ., LaFayette, IN. Dept. of Forestry and Natural Resources.  
A. Spacie, J. L. Hamelink, and R. C. Waybrant.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F. L. Mayer, and J. L. Hamelink, eds., American Society for Testing and Materials, p 214-227, 1977. 4 fig, 3 tab, 1 p, 19 ref.

**Descriptors:** \*Mathematical models, \*Physicochemical properties, \*Evaporation, Toxicity, \*Water analysis, Persistence, Aquatic Environment, Organic compounds, Kinetics, Thermal stratification, DDE, DDT, Epilimnion, Hypolimnion, Pesticide kinetics, Path of pollutants, Hazards, Chemical properties, Lentic environment.

A simple two-layer model for predicting evaporative losses of nonionic synthetic chemicals from water is presented. Losses from well-stirred small vessels are predicted accurately. Losses from thermally stratified bodies of water were poorly predicted because turbulent mixing processes at the interfaces were retarded. (See also W78-06608) (EIS-Deal)  
W78-12982

**ACCUMULATION OF AMERICIUM 243 IN SELECTED BRACKISH AND MARINE INVERTEBRATES,**  
Commission of the European Communities, Ispra (Italy). Joint Research Centre.  
C. A. Murray, M. Hoppenheit, and H. Rade.  
Helgolander Wissenschaftliche Meeresuntersuchungen, Vol 31, p 34-54, 1978. 15 fig, 19 ref.

**Descriptors:** \*Radioisotopes, \*Worms, \*Copepods, \*Amphipoda, \*Radioecology, Path of pollutants, Physicochemical properties, Absorp-

tion, Hydrogen ion concentration, Radioactive wastes, Radioactive waste disposal, \*Americium, \*Polychaetes, \*Bioavailability, \*Tissue analysis, \*Bioaccumulation.

As an initial step in a program designed to investigate factors which are of importance in affecting the behavior of actinides towards certain invertebrates found in estuarine and marine environments, laboratory procedures have been developed to study the accumulation of americium in three species: the polychaete worm *Nereis diversicolor*, the brackish-water amphipod *Gammarus duebeni* and the harpacticoid copepod *Tisbe holothuriae*. It was found that large differences in concentration factors occurred for the same organisms, depending upon aging of the contaminated medium; much higher and more variable values being found when uptake was from freshly contaminated solutions than from those aged up to a week. The interaction of specimens with physico-chemical reactions of americium which appear to take place within the first few days after its introduction into water are considered to be responsible for these differences. Uptake from contaminated water that had been allowed to age in the absence of organisms appears to be unaffected by subsequent conditioning by specimens. The possibility that the mechanisms regulating the uptake of actinides in different species may depend upon pH is briefly discussed. (EIS-Deal)  
W78-12988

**CONCENTRATION OF MERCURY IN MARINE ANIMALS,**  
Hokkaido Univ., Hakodate (Japan). Lab. of Marine Chemistry.  
K. Matsunaga.  
Bulletin of the Faculty of Fisheries of Hokkaido University, Vol 29, No 1, p 70-74, 1978. 1 tab, 23 ref.

**Descriptors:** \*Mercury, \*Food chains, Metals, Heavy metals, Path of pollutants, Food habits, Fish physiology, Animal metabolism, Clams, Bass, Salmonids, Respiration, \*Marine animals, \*Tissue analysis, \*Bioaccumulation, \*Biomagnification.

About 200 marine animals were classified on the basis of food habit. The concentrations of mercury in them were measured and the mechanism of mercury accumulation was examined. Based on the results, it is likely that mercury accumulation in marine animals depends on food chain amplification. (EIS-Deal)  
W78-12991

**AN AQUEOUS AND SEDIMENTOLOGICAL MODEL FOR HEAVY METAL CONTAMINATION OF STREAM SYSTEMS AFFECTED BY SULFIDE MINING IN THE EASTERN UNITED STATES,**  
Duke Univ., Durham, NC. Dept. of Geology.  
E. L. Schrader, and W. J. Furbish.  
Bulletin of Environmental Contamination and Toxicology, Vol 20, p 159-166, 1978. 1 fig, 3 tab, 13 ref.

**Descriptors:** \*Mine wastes, \*Sulfides, \*Pyrite, Sulfur compounds, Water pollution sources, Water chemistry, Water analysis, Mine acids, Hydrogen ion concentration, Iron, Manganese, Heavy metals, Cadmium, Zinc, Copper, Nickel, Lead, Georgia, Model studies, Path of pollutants.

Small streams in the southeastern U.S. can be significantly contaminated by abandoned mining operations. Heavy metal contamination of such stream systems may be a function of the cyclic precipitation and dissolution of Fe-Mn oxyhydroxides. Since these mines are no longer operative and many of the original companies defunct, no private company is willing to regulate the rates of metal accumulation in stream waters. The unregulated waters pose a hazard for rural communities



and natural ecological systems within the drainage basins. (EIS/Deal)  
W78-12999

## 5C. Effects Of Pollution

**DISTRIBUTION OF PHYTOPLANKTON IN VIRGINIA LAKES,**  
Nevada Univ., Las Vegas. Dept. of Biological Sciences.  
J. W. Hilgert, V. W. Lambou, F. A. Morris, R. W. Thomas, and M. K. Morris.

Descriptors: \*Virginia, \*Lakes, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Impoundments, \*Bioindicators, \*National Eutrophication Survey, Algae, Reservoirs, Distribution, Species diversity, Diversity indices, Species composition, Floral lists, Data collections, Claytor Lake(VA), John W. Flannagan Dam(VA), John H. Kerr Reservoir(VA), Occoquan Reservoir(VA), Smith Mountain Lake(VA), Chesdin Lake, Chickahominy(VA), Rivanna Reservoir(VA).

Phytoplankton species composition and abundance were determined for eight Virginia lakes and impoundments; trophic status was also assessed using several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, and species diversity and abundance indices. The project was conducted in spring, summer, and fall 1973 as a component of the National Eutrophication Survey. Sampling lakes were selected because of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluents, (2) surface area of at least 40 ha, and (3) a minimum hydraulic retention time of 30 days. Sites included Claytor Lake, John W. Flannagan Dam, John H. Kerr Reservoir (Buggs Island Lake), Occoquan Reservoir, Smith Mountain Lake, Lake Chesdin, Chickahominy Lake, and Rivanna (South Fork) Reservoir. Phytoplankton data are summarized in an appendix organized by lake, which contains an alphabetical species list with concentrations for each species by sampling date, and results of application of the indices. Nygaard's trophic state indices assume that certain algal groups indicate nutrient enrichment levels; eutrophic indicators are Cyanophyta, Euglenophyta, centric diatoms, and Chlorococcales, while desmids and many pennate diatoms are found only in oligotrophic waters. (Lynch-Wisconsin)  
W78-12122

**DISTRIBUTION OF PHYTOPLANKTON IN TENNESSEE LAKES,**  
Nevada Univ., Las Vegas. Dept. of Biological Sciences.  
F. A. Hiatt, S. C. Hern, J. W. Hilgert, V. W. Lambou, and F. A. Morris.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 139, Price codes: A04 in paper copy, A01 in microfiche. Publication No. EPA-600/3-78-016, January 1978. 67 p, 1 tab, 11 ref, 1 append.

Descriptors: \*Tennessee, \*Lakes, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Reservoirs, \*Impoundments, Bioindicators, Algae, Distribution, Species diversity, Diversity indices, Species composition, Floral lists, Data collections, National Eutrophication Survey, Barkley Lake(TN), Boone Reservoir(TN), Cheatham Reservoir(TN), Cherokee Lake(TN), Chickamauga Lake(TN), Douglas Lake(TN), Fort Loudon Lake(TN), Great Falls Lake(TN), Nickajack Reservoir(TN), Old Hickory Lake(TN), Watts Bar Lake(TN), Percy Priest Reservoir(TN), Tims Ford Reservoir(TN), South Holston Lake(TN), Reelfoot Lake(TN), Wood Reservoir(TN).

Phytoplankton species composition and abundance were determined for 16 Tennessee lakes and reservoirs; in addition, trophic status was assessed by means of several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices, and abundance indices. The study was conducted in spring, summer, and fall 1973 as part of the National Eutrophication Survey. Lakes were selected on the basis of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluent, (2) surface area of at least 40 ha, and (3) hydraulic retention time of at least 30 days. Lakes surveyed were Barkley, Cherokee, Chickamauga, Douglas, Fort Loudon, Great Falls, Old Hickory, Watts Bar, South Holston, and Reelfoot Lakes, and Boone, Cheatham, Nickajack, Percy Priest, Tims Ford, and Woods Reservoirs. Data are summarized by lake in an appendix containing alphabetical lists of phytoplankton species with concentrations of each by sampling date, and results of application of the indices. Nygaard's indices are based on algal groups known to be unique to eutrophic or oligotrophic waters. Palmer indices incorporate two lists of organic pollution-tolerant taxa, one with 20 genera, and one with 20 species. (Lynch-Wisconsin)  
W78-12123

**RELATIONSHIPS OF PRODUCTIVITY AND PROBLEM CONDITIONS TO AMBIENT NUTRIENTS: NATIONAL EUTROPHICATION SURVEY FINDINGS FOR 418 LAKES,**  
Environmental Monitoring and Support Lab., Las Vegas, NV.  
L. R. Williams, V. W. Lambou, S. C. Hern, and R. W. Thomas.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 452, Price codes: A04 in paper copy, A01 in microfiche. Publication No. EPA-600/3-78-002, January 1978. 20 p, 8 fig, 9 ref.

Descriptors: \*National Eutrophication Survey, \*Lakes, \*Eutrophication, \*Primary productivity, \*Phosphorus, \*Chlorophyll, \*Reservoirs, Nutrients, Phytoplankton, Macrophytes, Algae, Aquatic weed control, Fisheries, Fishkill, Dissolved oxygen, Oxygen depletion, Hydraulic residence time, Stratification, Hydrogen ion concentration, Alkalinity, Nitrogen, Limiting factors, Ponds, Impoundments.

Data collected on 418 lakes, ponds and reservoirs east of the Mississippi River in 1972-73 for the National Eutrophication Survey were analyzed to determine correlations between chlorophyll-a (as an indicator of lake productivity), nutrients, and other water quality parameters. Conclusions include: (1) Productivity, as measured by mean chlorophyll-a concentrations, is strongly related to ambient phosphorus levels, especially in lakes with hydraulic retention time greater than 14 days. (2) Significant regional differences in chlorophyll-a response per unit total phosphorus exist; the reasons are being investigated. (3) Classifying lakes on the basis of stratification, dominant vegetation, or fishery type results in no differences in chlorophyll-a response to phosphorus. (4) No algal blooms occur in lakes with mean total phosphorus concentrations less than 19 micrograms/liter. (5) Nuisance aquatic weed growths generally occur at lower phosphorus levels than did algal blooms, and in many cases control of phosphorus inputs is unlikely to have much impact on macrophytes. (6) Fishkills are generally unrelated to mean phosphorus or chlorophyll-a levels, or even to chronic low-oxygen conditions. (7) Many oxygen problems in southeastern lakes arise from establishment of trout fisheries in marginal habitats. Positive correlations were found between chlorophyll-a and phosphorus, Kjeldahl nitrogen, pH, and total alkalinity and negative correlations with Secchi disc transparency and nitrogen/phosphorus ratio. (Lynch-Wisconsin)  
W78-12124

**SEPTIC TANK DISPOSAL SYSTEMS AS PHOSPHORUS SOURCES FOR SURFACE WATERS,**  
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.  
For primary bibliographic entry see Field 5B.  
W78-12125

**DISTRIBUTION OF PHYTOPLANKTON IN OHIO LAKES,**  
Nevada Univ., Las Vegas. Dept. of Biological Sciences.  
J. W. Hilgert, V. W. Lambou, F. A. Morris, M. K. Morris, and L. R. Williams.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 140, Price codes: A06 in paper copy, A01 in microfiche. Publication No. EPA-600/3-78-015, January 1978. 94 p, 4 tab, 11 ref, 1 append.

Descriptors: \*Ohio, \*Lakes, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Reservoirs, \*Impoundments, Bioindicators, Algae, Distribution, Species diversity, Diversity indices, Species composition, Floral lists, Data collections, National Eutrophication Survey, Beach City Reservoir(OH), Buckeye Reservoir(OH), Charles Mill Reservoir(OH), Deer Creek Reservoir(OH), Delaware Reservoir(OH), Dillon Reservoir(OH), Grant Lake(OH), Hoover Reservoir(OH), Indian Lake(OH), Lorain Lake(OH), Mosquito Creek Reservoir(OH), Pleasant Hill Lake(OH), Lake Saint Marys(OH), Atwood Reservoir(OH), Berlin Reservoir(OH), Holiday Lake(OH), O'Shaughnessy Reservoir(OH), Rocky Fork Lake(OH), Shawnee Lake(OH), Tappan Lake(OH).

Phytoplankton species composition and abundance were determined for 20 Ohio lakes and reservoirs; in addition, trophic status was assessed by means of several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices, and abundance indices. The study was conducted in spring, summer, and fall 1973 as part of the National Eutrophication Survey. Lakes were selected on the basis of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluent, (2) surface area of at least 40 ha, and (3) hydraulic retention time of at least 30 days. Lakes surveyed were Beach City, Buckeye, Charles Mill, Deer Creek, Delaware, Dillon, Hoover, Mosquito Creek, Atwood, Berlin, and O'Shaughnessy Reservoirs; Grant, Indian, Lorain, Pleasant Hill, Holiday, Rocky Fork, Shawnee, and Tappan Lakes; and Lake Saint Marys (Grant Lake). Data are summarized by lake in an appendix containing alphabetical lists of phytoplankton species with concentrations of each by sampling date, and results of application of the indices. Nygaard's indices are based on algal groups known to be unique to eutrophic or oligotrophic waters. Palmer indices incorporate two lists of organic pollution-tolerant taxa, one with 20 genera, and one with 20 species. (Lynch-Wisconsin)  
W78-12126

**DISTRIBUTION OF PHYTOPLANKTON IN NEW JERSEY LAKES,**  
Environmental Monitoring and Support Lab., Las Vegas, NV.  
L. R. Williams, F. A. Morris, J. W. Hilgert, V. W. Lambou, and F. A. Hiatt.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 680, Price codes: A04 in paper copy, A01 in microfiche. Publication No. EPA-600/3-78-014, January 1978. 59 p, 3 tab, 11 ref, 1 append.

Descriptors: \*New Jersey, \*Lakes, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Reservoirs,

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

\*Impoundments, Bioindicators, Algae, Distribution, Species diversity, Diversity indices, Species composition, Floral lists, Data collections, National Eutrophication Survey, Budd Lake(NJ), Greenwood Lake(NJ), Oradell Reservoir(NJ), Pinecliff Lake(NJ), Pompton Lake(NJ), Duheral Lake(NJ), Farrington Lake(NJ), Lake Hopatcong(NJ), Lake Musconetcong(NJ), Paulinsk Lake(NJ), Spruce Run Reservoir(NJ), Union Lake(NJ), Wanaque Reservoir(NJ).

Phytoplankton species composition and abundance were determined for 13 New Jersey lakes and reservoirs; in addition, trophic status was assessed by means of several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices, and abundance indices. The study was conducted in spring, summer, and fall 1973 as part of the National Eutrophication Survey. Lakes were selected on the basis of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluent, (2) surface area of at least 40 ha, and (3) hydraulic retention time of at least 30 days. Lakes surveyed were Budd Lake, Greenwood Lake, Oradell Reservoir, Pinecliff Lake, Pompton Lake, Duheral Lake, Farrington Lake, Lake Hopatcong, Lake Musconetcong, Paulinsk Lake, Spruce Run Reservoir, Union Lake, and Wanaque Reservoir. Data are summarized by lake in an appendix containing alphabetical lists of plankton species with concentrations of each by sampling date, and results of application of the indices. Nygaard's indices are based on algal groups known to be unique to eutrophic or oligotrophic waters. Palmer indices incorporate two lists of organic pollution-tolerant taxa, one with 20 genera, and one with 20 species. (Lynch-Wisconsin) W78-12127

#### DISTRIBUTION OF PHYTOPLANKTON IN GEORGIA LAKES,

Nevada Univ., Las Vegas. Dept. of Biological Sciences.  
F. A. Morris, M. K. Morris, L. R. Williams, W. D. Taylor, and F. A. Hiatt.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 668, Price codes: A04 in paper copy, A01 in microfiche. Publication No EPA-600/3-78-011, January 1978. 63 p, 3 tab, 11 ref, 1 append.

Descriptors: \*Georgia, \*Lakes, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Impoundments, \*Reservoirs, Bioindicators, Algae, Distribution, Species diversity, Diversity indices, Species composition, Floral lists, Data collections, National Eutrophication Survey, Allatoona Lake(GA), Blackshear Lake(GA), Chatuge Lake(GA), Clark Hill Reservoir(GA), Jackson Lake(GA), Lake Sidney Lanier(GA), Nottley Lake(GA), Lake Seminole(GA), Lake Sinclair(GA), Lake Eufaula(GA), Blue Ridge Lake(GA), Bartlett's Ferry Reservoir(GA), Lake Burton(GA), High Falls Lake(GA).

Phytoplankton species composition and abundance were determined for 14 Georgia lakes and reservoirs; in addition, trophic status was assessed by means of several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices, and abundance indices. The study was conducted in spring, summer, and fall 1973 as part of the National Eutrophication Survey. Lakes were selected on the basis of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluent, (2) surface area of at least 40 ha, and (3) hydraulic retention time of at least 30 days. Lakes surveyed were Allatoona Lake, Blackshear Lake, Chatuge Lake, Clark Hill Reservoir, Jackson Lake, Lake Sidney Lanier, Nottley Lake, Lake Seminole (Jim Woodruff Reservoir), Lake

Sinclair, Lake Eufaula (Walter F. George Reservoir), Blue Ridge Lake, Bartlett's Ferry Reservoir (Harding Lake), Lake Burton, and High Falls Lake. Data are summarized by lake in an appendix containing alphabetical lists of phytoplankton species with concentrations of each by sampling date, and results of application of the indices. Nygaard's indices are based on algal groups known to be unique to eutrophic or oligotrophic waters. Palmer indices incorporate two lists of organic pollution-tolerant taxa, one with 20 genera, and one with 20 species. (Lynch-Wisconsin) W78-12128

#### DISTRIBUTION OF PHYTOPLANKTON IN KENTUCKY LAKES,

Environmental Monitoring and Support Lab., Las Vegas, NV.  
W. D. Taylor, F. A. Hiatt, S. C. Hern, J. W. Hilgert, and V. W. Lambou.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 667, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/3-78-013, January 1978. 28 p, 3 tab, 11 ref, 1 append.

Descriptors: \*Kentucky, \*Lakes, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Reservoirs, \*Impoundments, Bioindicators, Algae, Distribution, Species diversity, Diversity indices, Species composition, Floral lists, Data collections, National Eutrophication Survey, Lake Cumberland(KY), Dale Hollow Reservoir(KY), Herrington Lake(KY), Kentucky Lake(KY), Barren River Reservoir(KY).

Phytoplankton species composition and abundance were determined for five Kentucky lakes and reservoirs; in addition, trophic status was assessed by means of several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices, and abundance indices. The study was conducted in spring, summer, and fall 1973 as part of the National Eutrophication Survey. Lakes were selected on the basis of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluent, (2) surface area of at least 40 ha, and (3) hydraulic retention time of at least 30 days. Lakes surveyed were Lake Cumberland, Dale Hollow Reservoir, Herrington Lake, Kentucky Lake, and Barren River Reservoir. Data are summarized by lake in an appendix containing alphabetical lists of phytoplankton species with concentrations of each by sampling date, and results of application of the indices. Nygaard's indices are based on algal groups known to be unique to eutrophic or oligotrophic waters. Palmer indices incorporate two lists of organic pollution-tolerant taxa, one with 20 genera, and one with 20 species. (Lynch-Wisconsin) W78-12129

#### PROCEDURES FOR MEASURING COUGH (GILL PURGE) RATES OF FISH,

Environmental Research Lab.-Duluth, MN.  
For primary bibliographic entry see Field 5A. W78-12131

#### BIOASSAY PROCEDURES FOR THE OCEAN DISPOSAL PERMIT PROGRAM.

Environmental Research Lab., Gulf Breeze, FL.  
For primary bibliographic entry see Field 5A. W78-12132

BENZO(A)PYRENE METABOLISM IN THE AMERICAN OYSTER CRASSOSTREA VIRGINICA,  
Sloan-Kettering Inst. for Cancer Research, Rye, N.Y. Donald S. Walker Lab.  
R. S. Anderson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 390, Price codes: A02 in paper copy, A01 in microfiche. Environmental Protection Agency, Ecological Research Series, Report EPA 600/3-78-009, Jan 1978. 18 p, 3 tab, 1 fig, 27 ref.

Descriptors: \*Oysters, Bioassay, Methodology, \*Animal metabolism, \*Animal pathology, \*Animal physiology, Commercial shellfish, \*Enzymes, Polychlorinated biphenyls, Laboratory tests, \*Carcinogens, \*Benzo(a)pyrene, \*Enzyme induction, Mono-oxygenase, Mixed function oxidases, Carcinogen metabolism, Oyster enzyme system.

This research program was initiated with the overall objective of determining the role of NADPH-dependent microsomal mono-oxygenase in the metabolism of the widespread environmental carcinogen benzo(a)pyrene (BP) by the oyster *Crassostrea virginica*. This enzyme system is important in detoxifying various xenobiotics and inactivating polycyclic aromatic hydrocarbons on congeners as BP. An NADPH- and O<sub>2</sub>-dependent aryl hydrocarbon hydroxylase (AHH) was shown to be located in the digestive glands of these bivalves associated with the microsomal subcellular fraction. The specific activity of oyster AHH was considerably lower than that of laboratory mice, but was consistently demonstrable. The BP metabolites produced were primarily water-soluble derivatives. There was some indication that oyster AHH was induced by chronic exposure of the animals to the environmental carcinogens BP and 3-methyl-cholanthrene. There was strong evidence that exposure to polychlorinated biphenyls (PCB) caused AHH induction. High-pressure liquid chromatography was used to identify BP metabolites produced by oyster AHH. (EIS-Katz) W78-12133

#### BIOLOGICAL EFFECTS OF PESTICIDES ON THE DUNGENESS CRAB,

Oregon State Univ., Newport. Marine Science Center.  
R. S. Caldwell.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 978, Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Agency, Ecological Research Series, November 1977. Report EPA 600/3-77-131, 125 p, 23 tab, 69 fig, 78 ref.

Descriptors: \*Crabs, Commercial shellfish, \*Bioassay, Methodology, Laboratory tests, Laboratory animals, Invertebrates, Toxicity, Mortality, Water pollution effects, \*Pesticides, \*Herbicides, Larvae, Larval growth stages, \*Fungicide, \*Chlorinated hydrocarbon pesticides, \*Organophosphorus pesticides, Methoxychlor, Captan, Carbofuran, Chlordane, Malathion, 2,4-D, Propanil, DEF, Trifluralin.

The toxicity of nine pesticides to various life history stages of the Dungeness crab, *Cancer magister*, was examined to establish the most sensitive life stage of the crab, and the highest concentration of each pesticide having no discernible effect on that most sensitive stage during prolonged exposures. The compounds tested were the insecticides carbofuran, chlordane, malathion, and methoxychlor; the herbicides 2,4-D, DEF, propanil and trifluralin; and the fungicide captan. For each pesticide, the zoal stages were found to be the most sensitive in long-term tests, approximately 5 to 10 times and 10 to 100 times more sensitive than juvenile and adult crabs, respectively, and were also affected at lower concentrations than those that affected egg hatching and prezoal development. The maximum acceptable toxicant concentrations for continuous exposures of *C. magister* zoaea to each of the nine pesticides are: methoxychlor, 0.005 microg/l; chlordane, 0.015 microg/l; malathion, 0.02 microg/l; carbofuran, 0.05 microg/l; captan, 2 microg/l; DEF, 4 microg/l; trifluralin, 15 microg/l; propanil, 80 microg/l, and 2,4-D 1000 microg/l. The toxicity of each of these

pesticides to literature review species. (EIS-Katz) W78-12134

CALIFORNIA LANDSAT VESTIGAT Army Engi D. M. Pirie Available tion Service Price code U.S. Army port to N April 1977.

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SURLET MENTS Maryland Inst. J. M. O' Jr. Availab tion Ser 646, Pri microfiche Research February pend. DA

Descripti solids, ment, E Water gineerin facts.

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pesticides to crabs is presented and compared with literature reports of their toxicity to other aquatic species. (EIS-Katz)  
W78-12134

**CALIFORNIA COASTAL PROCESSES STUDY - LANDSAT II. FINAL REPORT: LANDSAT INVESTIGATION NO 22200.**  
Army Engineer District, San Francisco, CA.  
D. M. Pirie, and D. D. Steller.  
Available from the National Technical Information Service, Springfield, VA 22161 as N77-24553. Price codes: A08 in paper copy, A01 in microfiche. U.S. Army Engineer District, San Francisco Report to NASA, Goddard Space Flight Center, April 1977. 163 p, 8 tab, append. S54062A.

Descriptors: \*California, \*Coasts, \*Baseline studies, \*Shore protection, \*Sediment transport, \*Littoral, Remote sensing, Resources development, Environmental effects, \*Outer Continental Shelf, \*Coastal processes, \*Coastal zone management, Landsat II, Nearshore processes, Estuarine flushing, Outfall structures.

Landsat data are used in the analysis and description of long and short-term littoral and nearshore processes along the California coast. The effects of these processes on natural and modified shorelines and the capability to demonstrate the utility of Landsat derived information are important considerations of the U.S. Army Corps of Engineers in coastal protection, coastal zone management and engineering planning. The processes studied include sediment transport, river discharge, nearshore currents, and estuarine flushing. Landsat data as well as aerial photography and surface data covering a four year period were analyzed to determine the variability of coastal processes. The specific objectives of this investigation included the determination of sediment transport parameters measurable in the Landsat data and application of this information to everyday coastal planning and construction. (Sinha-OEIS)  
W78-12179

**SUBLETHAL EFFECTS OF SUSPENDED SEDIMENTS ON ESTUARINE FISH.**  
Maryland Univ., Solomons. Natural Resources Inst.

J. M. O'Connor, D. A. Neumann, and J. A. Sherck, Jr.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A040 646. Price codes: A05 in paper copy, A01 in microfiche. Report to Army Coastal Engineering Research Center Technical Paper No. TP-77-3, February 1977. 90 p, 15 fig, 19 tab, 64 ref, 4 append. DACW72-71-C-0003.

Descriptors: \*Estuaries, \*Fish, \*Suspended solids, \*Maryland, \*Dredging, Resources development, Baseline studies, Environmental effects, Water resources, Water pollution effects, Engineering, Outer Continental Shelf, Sublethal effects.

The effects, if any, of sublethal concentrations of suspended materials on the fish in estuarine systems were determined. Experimental sediment suspensions reproduced the concentrations frequently found during flooding and at dredging sites and dredged-material disposal sites. The suspensions were of natural sediment, obtained from the Patuxent River estuary, Maryland, or commercially available fuller's earth. The selected fish species inhabited ecologically different sections of the estuary; therefore, the overall reactions of each species were unique. Seven species of estuarine fish were exposed to fuller's earth and natural sediment suspensions for timed periods and hematological changes were noted. The effects of various concentrations of fuller's earth suspensions on white perch gill tissue were determined. Oxygen consumption rates of striped bass, white perch, and toadfish were measured in fil-

tered river Patuxent River water and compared to consumption rates in filtered river water suspensions of fuller's earth or Patuxent River sediment. Fish showed signs of stress in response to suspended sediments in most of the experiments. Results indicate that sublethal concentrations of suspended solids can affect estuarine fish. (Sinha-OEIS)  
W78-12183

**PECULIARITIES OF BIOLOGICAL PRODUCTIVITY OF WATERS NEAR BIRD'S BAZAARS IN THE NORTH OF NOVAYA ZEMLYA (SOBENNOSTI BIOLOGICHESKOI PRODUKTIVNOSTI VOD BLIZ PTCHIKA BAZAROV SEVERA NOVOI ZEMLI, LENINGRAD, 1972).**  
Sovetskii Natsionalnyi Komitet po Provedeniyu Mezhdunarodnoi Biologicheskoi Programmy, Moscow (USSR).  
A. N. Golvin.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 499-T. Price codes: A07 in paper copy, A01 in microfiche. Translation for the Fish and Wildlife Service, and the National Science Foundation, 1976. 130 p.

Descriptors: \*Birds, \*Arctic Ocean, \*Ecosystems, \*Baseline studies, Nutrients, Resources development, Water resources, Hydrology, Plankton, \*Productivity, Outer Continental Shelf, USSR, Novaya Zemlya, Technical translations, Plotus alle.

The book contains the articles summarizing the material on hydrology, hydrochemistry, phyto- and zooplankton and marine colonial birds collected by the Murmansk Marine Biological Institute expedition during August 1967. The main purpose of these investigations is to give characteristics of the conditions that caused high biological production ensuring nourishment of numerous sea birds. The inverse connection of birds with marine biocoenosis is also analyzed—the influence of water fertilization by bird excrements upon water biological productivity. Data are given on the distribution of biogenic elements, phyto- and zooplankton in the region of the Arkhangelsk gulf and the Vilkitskii bay of Novaya Zemlya. An estimation of the number of marine colonial birds is carried out in this region. Characteristics of the feeding relationships of little auks (Plotus alle) with a pelagic association are given. The book contains the original material characterizing scarcely explored regions and throwing light on some regularities of the organic matter circulation in the sea. (Sinha-OEIS)  
W78-12184

**DEEP OCEAN MINING ENVIRONMENTAL STUDY (DOMES). PHYTOPLANKTON & PRIMARY PRODUCTIVITY STUDIES; PRELIMINARY REPORT.**  
Texas A and M Univ., College Station. Dept. of Oceanography.  
S. Z. El-Sayed, S. Taguchi, G. Fryxell, and K. Buck.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 699. Price codes: A04 in paper copy, A01 in microfiche. NOAA, Environmental Research Laboratories, Deep Ocean Mining Environmental Study (DOMES), Unpublished Manuscript No. 2, May 1976. 56 p, 19 fig, 10 tab, 10 ref.

Descriptors: \*Phytoplankton, \*Primary productivity, \*Mining, \*Baseline studies, Standing crops, Environmental effects, Outer Continental Shelf, Ocean mining, Deep Ocean Mining Environmental Study (DOMES).

While the objectives of the post RP-8-OC-76 cruise report were primarily to present data, this report dwells more on the analysis and interpretation of that data. The first objective is to provide the baseline information on the phytoplankton

community which will be necessary to evaluate post mining populations to determine what, if any, effects mining has on them. The parameters of standing crop and primary production are used to define the baseline population. The physiological state and efficiency of the organisms, determined from pigment ratios, cell counts and assimilation ratios as well as the depth of the pigment and primary production maxima, the amount of standing crop and production below the 1% light level and the presence or absence of seasonal changes in standing crop and primary production are all factors which will be used to characterize this pre-mining population. The second objective of the study is to predict in advance what effects mining will have upon the phytoplankton of the DOMES region. In evaluating post-mining operations the effect upon individual stations should be considered. These post-mining effects may be subtle in nature and not easily identified, for instance, species changes may have a major effect upon higher trophic levels but could produce no noticeable differences in chlorophyll or production. Any post-mining environmental studies should be as intensive and detailed as the preliminary studies. (Sinha-EIS)  
W78-12185

**DIURNAL AND SEASONAL FLUCTUATIONS OF ORGANISMS IN A NORTH FLORIDA ESTUARY.**  
Florida State Univ., Tallahassee. Dept. of Biological Science.  
A. J. Livingston.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 464. Price codes: A03 in paper copy, A01 in microfiche. Reprinted from: Estuarine and Coastal Marine Science, Vol. 4, p 373-400, 1976. 9 fig, 6 tab, 63 ref. SG-04-3-158-43.

Descriptors: \*Aquatic life, \*Estuaries, \*Environmental effects, \*Water pollution, \*Florida, Seasonal variations, Diurnal, Bioindicators, Fish, Invertebrates, Outer Continental Shelf, Species diversity.

Monthly samples of demersal fishes and invertebrates were taken in an unpolluted, river-dominated estuary in north Florida (Apalachicola Bay) for a 2-year period. Various methods of analysis were used to determine adequate sample size for comparative analysis of the results. Several species richness and diversity indices were compared. Regular diurnal (24-h) and seasonal variations of such parameters were related to complex interactions which included river flow, salinity variations and temperature changes. Although there were some variations, a general pattern of an annual double peak of fish and invertebrate richness and diversity was noted. Nocturnal patterns were more clearly defined than diurnal ones. Relative dominance remained high, with a seasonal succession of dominant fish and invertebrate species. It was postulated that there was a constantly changing series of interactions of the various community components that precluded a single mechanism for the observed phenomena. Apalachicola Bay was seen as an unpolluted system that underwent considerable seasonal fluctuations of richness and diversity in response to extreme variations of natural (physical) functions. Such changes were stable over time, and this form of variation was seen as a considerable limitation to the general use of species diversity as an indicator of pollution and other man-induced activities in such estuarine systems. (Sinha-OEIS)  
W78-12186

**SIGNIFICANCE OF PHENOLIC COMPOUNDS IN THE DELAWARE ESTUARY.**  
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.  
S. D. Faust, W. H. Clement, and G. T. Hunt.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 755,



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

Price codes: A02 in paper copy, A01 in microfiche. Report to National Science Foundation, Research Applied to National Needs (RANN) for the project 'Petroleum Industry in the Delaware Estuary', May 1975. 14 p, 3 fig, 1 tab, 6 ref. NSF-GI42282.

Descriptors: \*Estuaries, \*Aquatic life, \*Water pollution effects, \*Phenolic pesticides, Fish, Toxicity, Oysters, Outer Continental Shelf, Delaware Estuary, Chlorophenols, Phenol compounds.

An examination of data shows levels of phenolics exist in the Delaware Estuary that may be harmful to aquatic fauna. Many samples taken from the Delaware Estuary exceeded the 0.02 mg/l level, and are therefore capable of inducing lesions in fish. Although only a limited investigation of muds has been made, it appears that the phenolics may accumulate in the estuary sediments and muds. The potential exists for release of these higher concentrations of phenolics to the overlying waters. Scavengers and benthic species may be affected by these larger amounts of phenolics in the muds. Results of the first year survey detect two zones of 'high' phenolic concentrations in the estuary: (1) the area from Palmyra, New Jersey to below Petta's Island; and (2) a broader zone extending from the Wilmington-Penns Grove area to below the Delaware and Chesapeake Canal. Below this zone lie the important oyster beds. The danger (to the oyster) exists in that these phenolics in the estuary may be chlorophenols. Phenolic concentrations existing now in the Delaware Estuary must be considered as significant levels. This is especially true since the exact nature of these phenolic materials are, at present, unknown. (Sinha-OEIS) W78-12190

**EFFECT OF THERMAL SHOCK ON DEVELOPMENTAL STAGES OF ESTUARINE FISH.** South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. J. M. Dean. Available from the National Technical Information Service, Springfield, VA 22161 as SRO 869-2. Price codes: A02 in paper copy, A01 in microfiche. Report to Energy Research and Development Administration, December 1976. 12 p, 3 fig, 1 tab. ERDA-E(38-1)869.

Descriptors: \*Estuaries, \*Fish, \*Thermal stress, \*Environmental effects, Baseline studies, Water resources, Resources development, Thermal pollution, Outer Continental Shelf, Fundulus heteroclitus, Thermal pollution, Thermal shock, Heat pollution.

Present dogma would have it that the larval and juvenile stages of aquatic species are most sensitive to environmental perturbations. However, there is some evidence that this might not be consistent for all species. The present study has examined the response of the larval and juvenile stages of the estuarine fish *Fundulus heteroclitus* to acute thermal shock. (Sinha-OEIS) W78-12191

**INTERIM ENVIRONMENTAL SYNTHESIS OF THE NORTHEAST GULF OF ALASKA.** Science Applications, Inc., Boulder, CO. For primary bibliographic entry see Field 6G. W78-12192

**THE ATTACHMENT OF ZYGOTES AND GERMLINGS OF HALIDRYS SILIQUOSA (L.) LYNGB. (PHAEOPHYCEAE, FUCALES).** Newcastle-upon-Tyne Univ. (England). Dept. of Biology. F. G. Hardy, and B. L. Moss. Phycologia, Vol. 17, No. 1, p 69-78, 1978. 18 fig, 25 ref.

Descriptors: \*Halidrys siliquosa, \*Zygotes, \*Germlings, \*Attachment, \*Sessile algae,

\*Intertidal areas, \*Estuarine environments, Phaeophyceae, Fucales, Phaeophyta, Algae, Rhizoids, Cytological studies, Electron microscopy, Thalli, Water movement.

Mode of development of the phaeophyte sessile alga *Halidrys siliquosa* and its characteristic attachment mechanism were studied. In all species of Fucales permanent attachment is accomplished by rhizoids produced throughout the life of the plant and which eventually form the holdfast. As there is considerable water movement in intertidal habitats, the free-floating oospores must sink and become attached to the substratum soon after fertilization or be either swept out to sea or cast up in the drift weed. The length of time for rhizoids to appear after fertilization varies among species. In *H. siliquosa* there is a lapse of several days before rhizoids are produced from the zygote. In order to remain attached to the substratum until this time, the zygote rapidly secretes and deposits rigid adhesive with associated adhesive with associated adhesive mucilages. The cell wall proper is laid down inside this zygote wall. A multicellular spherical germling develops and once the rhizoid system has formed, the zygote wall is shed from the thallus in the form of a cap. Four primary rhizoids are followed by the production of more rhizoids thereafter, resulting in the progressive build-up of the holdfast of the adult. For this study fertile *H. siliquosa* material was collected from rock pools at Beadnell, Northumberland, Great Britain between January and March. (Lynch-Wisconsin) W78-12199

**THE MORPHOLOGICAL VARIATION OF PTEROCLADIA CAERULESCENS (GELIDIALES, RHODOPHYTA) IN HAWAII.** Hawaii Univ., Honolulu. Dept. of Botany. B. Santelices. Phycologia, Vol. 17, No. 1, p 53-59, 1978. 4 fig, 37 ref.

Descriptors: \*Plant morphology, \*Pterocladia caerulescens, \*Seasonal, \*Plant growth, \*Water movement, \*Light intensity, Vertical distribution, Intertidal areas, Subtidal areas, \*Algae, Rhodophyta, Gelidiales, \*Hawaii, Oahu(HI), Thalli, Tetraspores, Apices, Phenology, Fertility.

Growth patterns of the rhodophyte alga *Pterocladia caerulescens* correlated best with seasonal changes of water movement and light intensity in a phenological investigation of Hawaiian reef populations. Response varied with vertical distribution. In subtidal plants the main axes elongated July-December, a period of increased water movement and decreased light intensity. Following additive growth, tetraspore formation, shedding, and apical decay occurred, thus shortening the axes and reducing the number of branches. This annual process, combined with apparently continuous growth in the breadth of main axes in plants older than one year, results in morphologically different sterile and tetrasporangial thalli. In intertidal populations, main axes are shorter, narrower, and less branched than subtidal plants. Intertidal thalli could not be found after January, correlating with increased average daily emersion time, but began appearing again in April-May: from July to December they displayed growth and reproduction patterns similar to subtidal populations. No evidence of morphological differences between sterile and tetrasporangial plants was found in the annual intertidal population. Sampling was carried out monthly over one year (July 1973-June 1974) at two localities: a shallow, flat reef on the windward side of Oahu, and an artificial wall on the leeward side of Oahu. Changes in biomass, thallus size, and fertility were recorded. (Lynch-Wisconsin) W78-12200

**A COMPARISON OF THE ZOOPLANKTON OF LAKE KAINJI AND OF THE RIVERS NIGER AND SWASHI.** Reading Univ. (England). Dept. of Zoology.

N. V. Clarke. Hydrobiologia, Vol. 58, No. 1, p 17-23, 1978. 3 tab, 9 ref.

Descriptors: \*Zooplankton, \*Niger River, \*Swashi River(Nigeria), \*Lake Kainji(Nigeria), \*Impoundments, \*Abundance, Rivers, La'ces, Nigeria, Baseline studies, Crustaceans, Faunal lists, Rotifers, Copepods, Cladocerans, Species composition, Lotic environment.

Changes in zooplankton abundance and species composition following creation of Lake Kainji, Nigeria through impoundment of the Niger River in August 1968 were determined using samples taken from the lake, the Niger River, and the Swashi River, a tributary. Zooplankton at the site of the future lake were studied in August 1965, and sampling was again done in August 1968 and during 1974-75. Results showed much greater zooplankton development in Lake Kainji than in the rivers. The cladoceran *Bosmina* spp and the cladoid copepod *Tropodiatomus banforanus* were relatively more abundant in the lake than in the rivers, while the reverse was true for the cladoceran *Moina micrura* and the rotifers *Brachionus falcatus* and *B. caudatus*. Decapod larvae of the river prawn were common in river samples in 1965, but unknown in the lake in 1974-75. Occurrence of insect larvae and nymphs, water mites, and fish larvae were greater in 1965 river samples than in the lake. The scarcity of plankton in the Niger River has been attributed to low nutrient concentrations and poor light penetration, but zooplankton development has also been reported to be poor in flowing waters compared with impoundments. In the Swashi River significant variations in relative abundance of zooplankton species were found along the course of the river, probably determined by streamflow and transparency. (Lynch-Wisconsin) W78-12201

**AN INTRODUCTION TO THE LIMNOLOGY OF THE FRIESIAN LAKES.** Limnological Inst., Oosterzee (Netherlands). Tjeukemeer Field Station. For primary bibliographic entry see Field 5A. W78-12202

**DIET FEEDING AND RESPIRATION RHYTHMS IN ZOOPLANKTON.** Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences. W. S. Duval, and G. H. Geen. Limnology and Oceanography, Vol. 21, No. 6, p 823-829, November 1976. 5 fig, 2 tab, 18 ref.

Descriptors: \*Zooplankton, \*Diel rhythms, \*Feeding, \*Respiration, \*Biorhythms, British Columbia(Canada), \*Canada, Lakes, Darkness, Dawn, Dusk, Oligotrophy, Eutrophication, Eunice Lake(B.C.), Deer Lake(B.C.), Babine Lake(B.C.).

The extent and generality of diel feeding and respiration rhythms of mixed and single-species zooplankton samples from Eunice, Deer, and Babine Lakes in British Columbia, Canada were examined in laboratory experiments conducted in darkness at constant temperature. Typically bimodal endogenous rhythms in respiration and feeding were demonstrated at 10-22°C with maximum rates at dawn and dusk and lowest values near midday. Dawn and dusk respiration rates were an average of 2.3 times higher than during midday and feeding rates were 6.6 times higher. Rhythms were observed in zooplankton from both oligotrophic and eutrophic lakes, in cladocerans and copepods, and at different times of the year. Three feeding and five respiration experiments were conducted over four years, each consisting of six consecutive four-hour experiments with animals from one of the lakes. All tests but one involved mixed species. Average respiration decreased by 1.9 times from dawn to midday, then increased by 2.7 times from noon to dusk. Average

feeding decreased by 6.1 times from dawn to noon, while noon to dusk rates increased by a factor of 7.1. As precise timing of maxima was not possible, observed changes in amplitude at dawn and dusk may be underestimated. Results support the hypothesis that timing of maxima is associated with the onset of dawn and dusk. (Lynch-Wisconsin) W78-12203

#### INTERACTIONS BETWEEN SEDIMENTS AND OVERLYING WATERS IN AN EXPERIMENTALLY EUTROPHIC PRECAMBRIAN SHIELD LAKE,

Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst. D. W. Schindler, R. Hesslein, and G. Kipphut. Freshwater Institute Reprint No. 487; Interactions Between Sediments and Fresh Water; Proceedings of an international symposium, Amsterdam, September 1976; p 235-243. 6 fig, 4 tab, 30 ref.

Descriptors: \*Sediment-water interfaces, \*Eutrophication, \*Nutrient flux, \*Lake 227 (Ontario Canada), Lakes, Precambrian Shield, Canada, Ontario (Canada), Nutrients, Phosphates, Nitrogen, Dissolved oxygen, Hypolimnion, Model studies, Tracers.

Study of the role of sediments in the nutrient economy of Lake 227, a small artificially enriched Precambrian Shield lake in the Experimental Lakes Area of northwestern Ontario showed that: (1) Pore water gradients of phosphorus were absent or weak and concentrations were low. (2) Sediments did not release significant amounts of phosphorus to overlying waters under either oxic or anoxic conditions, as confirmed by mass-balance techniques. (3) Almost all sediment phosphorus was bound to the particulate fraction. (4) Steep gradients of ammonium-nitrogen in pore waters indicated that over 50% of summer epilimnetic total nitrogen could potentially be replaced from littoral sediments each day, though nutrients released from the hypolimnion or its sediments were not important in the maintenance of mid-summer epilimnetic algal blooms because vertical eddy diffusion in the thermocline region was less than 0.001 sq cm/sec. Horizontal rather than vertical water movements were chiefly responsible for nitrogen and carbon distribution in the water column. Lead-210, cesium-137, radium-226, and added nutrients were used to measure recent sedimentation rates and mixing depths. Sedimentation averaged 1.0 mm/yr, and recently deposited material was found mixed to a depth of 5-10 cm. The half-time for establishing a new equilibrium between the sediment mixed layer and overlying water is estimated at 35 years. Data for this study covers 1969-75. (Lynch-Wisconsin) W78-12204

#### INFLUENCES OF LIGHT REGIME ON POSTEMBRYONIC DEVELOPMENT IN TWO STRAINS OF DAPHNIA PULEX,

Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences. P. L. Starkweather. Limnology and Oceanography, Vol. 21, No. 6, p 830-837, November 1976. 3 fig, 2 tab, 35 ref.

Descriptors: \*Daphnia pulex, \*Light, \*Darkness, \*Photocycles, \*Growth stages, \*Animal growth, Zooplankton, Cladocerans, Crustaceans, Ponds, Lakes, Molting, Instars, Nutrients, Eutrophication.

The development rates of preadults of two strains of the cladoceran *Daphnia pulex* reacted differently to variations in light regime. One strain, from a small pond at Ithaca, New York, developed more slowly when reared in continuous illumination or continuous darkness than when held in a photocycle. Relative length of the light and dark periods in 24-hr photocycles had no effect on development rate. The second strain, isolated

from a large eutrophic lake near Saratoga Springs, New York, developed at comparable rates in both photocycle and continuous light regimes, but differed in primiparous instar timing. These effects were probably independent of nutritional differences. Both strains were reared for several parthenogenetic generations in the laboratory, and single females of each were selected to start cloned populations. The daphnids were fed axenically grown *Chlamydomonas reinhardtii*; stocks of each clone were maintained under photocycles of LD 16:8 at 12°C. Each animal in a cohort was observed once or twice daily for 5-6 instars, and individual carapace molts were recorded. Animals held in darkness were observed for a maximum of 10 minutes daily using a deep-red safelight. It is possible that continuous darkness or continuous illumination inhibits feeding and produces starvation-mediated retardation in the pond strain. (Lynch-Wisconsin) W78-12205

#### PRODUCTION OF EPIBENTHIC SALT MARSH ALGAE: LIGHT AND NUTRIENT LIMITATION,

Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program. C. D. Van Raalte, I. Valiela, and J. M. Teal. Limnology and Oceanography, Vol. 21, No. 6, p 862-872, November 1976. 9 fig, 1 tab, 36 ref. NSF GA-28272, GA-28365, and GA-39722.

Descriptors: \*Limiting factors, \*Algae, \*Light, \*Nutrients, \*Primary productivity, \*Salt marshes, Great Sippewisset Marsh (MA), Massachusetts, Fertilizers, Urea, Phosphates, Nitrogen, Phosphorus, Seasonal, Benthic flora, Marsh plants, Grasses, Beneficial use, Sludge disposal, Model studies, Carbon radioisotopes.

Epibenthic algal production on test plots in Great Sippewisset Marsh, a salt marsh at Falmouth, Massachusetts was increased by high dosages of mixed fertilizer (25.2 g/sq m/wk), but not by treatment with urea or phosphate. The mix was 10% nitrogen, 6% phosphorus, and 4% potassium dried from secondary treatment plant sludge. Production followed a consistent seasonal pattern, with short-lived peaks in spring and fall. Algal production at the marsh surface was limited by shading from the marsh grass canopy; production of the grasses was also increased by fertilization. Additional plots were enriched with three levels of nitrogen, suspected as the limiting nutrient, to separate effects of light and nutrients; three levels of canopy cover were provided. Algal production was reduced by the shading and increased nitrogen fertilization. Predictions using a light-limitation model of epibenthic production compared well with observed measurements when grasses were dormant, but during the grass growing season the predicted production rate was higher than that observed. Fertilization was largely carried out at low tide on the plots, 10 m in radius. Mixed fertilizers were broadcast biweekly May-November at two levels, 25.2 and 8.4 g/sq m/wk. Urea (46% nitrogen by wt) was added at 5.6 g/sq m/wk. Phosphate granules, 20% phosphorus by wt, were added at 6.5 g/sq m/wk. A carbon-14 method was used to measure algal production. (Lynch-Wisconsin) W78-12206

#### COMPARATIVE FINE-STRUCTURAL STUDIES ON FIVE MARINE SPECIES OF PYRAMIMONAS (CHLOROPHYTA,

PRASINOPHYCEAE), Washington Univ., Friday Harbor. Friday Harbor Labs.

R. E. Norris, and R. N. Pienaar. Phycologia, Vol. 17, No. 1, p 41-51, 1978. 22 fig, 1 tab, 16 ref. NSF-GA-27310.

Descriptors: \*Pyramimonas amyliifera, \*Cytological studies, \*Scales, \*Plant morphology, \*Classification, \*Identification, \*Algae, Phytoplankton, Pyramimonas parkeae,

Pyramimonas disomata, Pyramimonas orientalis, Pyramimonas pluriculata, Chlorophyta, Electron microscopy, Washington, Lagoons, Oceans, Flagellates, Speciation.

The ultrastructure of five marine species of the chlorophyte genus *Pyramimonas* collected in waters surrounding San Juan Island, Washington was studied, with particular attention to body and flagellar scales and other cell details (such as pyrenoid structure) useful in delineating species. An electron microscope was essential for differentiating many species. Studied were *Pyramimonas amyliifera*, *P. parkeae*, *P. aff. disomata*, *P. orientalis*, and *P. aff. pluriculata*. Surface water samples were collected from Jakle's Lagoon, Old Town Lagoon, Log Lagoon, and Argyle Lagoon in September 1974 during an unusually dry and warm period, and in November 1974 after rain and wind had filled the lagoons. Cells were cultured in Provasoli's medium. *Pyramimonas* has a more complex structure than most green algal flagellates, in large part due to production of six types of scales laid down in precise layers and positions on the cells. Cell shape and size are variable among species, but are often unreliable as distinguishing features, especially among smaller species. Species which can be identified using only light microscopy include *P. parkeae*, *P. amyliifera*, and *P. grossii*. For other species electron microscopy is needed to discern the cell scales, which, when present, are often distinctive for a species. Scales in the intermediate layer on the cell body are especially useful. This paper includes a systematic discussion of the species. (Lynch-Wisconsin) W78-12207

#### GROWTH IN VARYING CULTURE CONDITIONS OF EMBRYOS OF THREE HAWAIIAN SPECIES OF SARGASSUM (PYAEOPHYTA,

SARGASSACEAE), British Columbia Univ., Vancouver. Dept. of Botany.

R. E. De Wreede. Phycologia, Vol. 17, No. 1, p 23-31, 1978. 2 fig, 10 tab, 9 ref.

Descriptors: \*Sargassum echinocarpum, \*Plant growth, \*Cultures, \*Embryonic growth stage, \*Salinity, \*Water temperature, Sargassum obtusifolium, Sargassum polyphyllum, Hawaii, Phaeophyta, Atolls, Intertidal areas, Phenology, Thalli, Rhizoids, Seasonal, Life history studies, Sargassaceae.

In order to clarify factors determining the seasonality and distribution of three Hawaiian species of *Sargassum* (Phaeophyta, Sargassaceae), embryos were grown 20 days at five salinities and four temperatures in seawater from four sources. Species investigated were *Sargassum echinocarpum*, *S. obtusifolium*, and *S. polyphyllum*. Elongation and expansion of leaf initials occurred in seawater from all sources except from outer reef surface water from Eniwetok Atoll. The other media were surface and deep (700 m) water from 16 km off the leeward coast of Oahu, and the same deep water enriched with Provasoli's medium (with vitamins omitted). Although growth occurred under almost all conditions, there was great variation in growth among the three species. Maximum elongation occurred most frequently at 24°C and 30-35‰ salinity, typical of Hawaiian winter and early spring coastal waters when these *Sargassum* species are reproductive. At higher temperatures and lower salinities, which generally occur in summer and early fall in shallow inshore areas, growth was usually less. Variation in only one factor, with the other factor kept optimum, also decreased growth. Failure to grow in the Eniwetok Atoll medium reflects the general absence of *Sargassum* from Micronesian atoll waters, due possibly to iron limitation or lack of chelating agents in atoll waters. (Lynch-Wisconsin) W78-12208

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

AN ASSESSMENT OF PRINCIPAL COMPONENT ANALYSIS FOR DESCRIPTION OF PHYTOPLANKTON PERIODICITY IN LAKE WINGRA, Wisconsin Univ.-Madison. Lab. of Limnology. S. M. Bartell, T. F. H. Allen, and J. F. Koonce. *Phycologia*, Vol. 17, No. 1, p 1-11, 1978. 4 fig, 4 tab, 37 ref. NSF AG-199, DEB 76-00761.

Descriptors: \*Principal component analysis, \*Phytoplankton, \*Ordination, \*Lake Wingra (WI), \*Seasonal, \*Analytical techniques, \*Statistical methods, Algae, Wisconsin, Madison (WI), Lakes, Species composition, Succession, Abundance, Biomass, Periodicity, Ice cover, Biological communities, Eutrophication.

Applicability of principal component analysis (PCA), an ordination approach, to the study of seasonal changes in phytoplankton species composition, was tested with data from Lake Wingra, Madison, Wisconsin. Other aspects evaluated were whether PCA can be used to find cause-effect relationships between species change and physico-chemical environmental changes, and the drawbacks of PCA in the study of species replacement. Compositional changes in Lake Wingra were examined during two sampling periods: (1) March 1970-April 1971 (56 samples), and (2) April 1972-August 1973 (58 samples). Analysis demonstrated a seasonal component in community composition, and summarized the dynamics of seasonal change in phytoplankton species composition. Two compositionally-stable periods (winter and summer) were found, separated by distinct spring and autumn transitional periods during which composition changed rapidly. A major advantage of the ordination approach is simultaneous consideration of all sampled species in describing community structures, possible with the chronological axis approach only for systems with very few species. Presence data, transformed as described in this paper, are concluded to provide sufficient resolution for summarizing seasonal changes in phytoplankton when treated by PCA. The specified transformations emphasize the dynamics of less-common species, normally obscured in quantitative analyses. (Lynch-Wisconsin) W78-12209

CONTRIBUTIONS TO THE ROTIFER OF WEST BENGAL. II. GENUS *LEPADELLA* DE ST. VINCENT, 1826, Zoological Survey of India, Calcutta. B. K. Sharma. *Hydrobiologia*, Vol 58, No 1, p 83-88, 1978. 3 fig, 20 ref.

Descriptors: \*Lepadella, \*Rotifers, \*West Bengal, \*India, \*Classification, Calcutta (India), Zooplankton.

Fourteen taxa (13 species and one form) of rotifers of the genus *Lepadella* collected in Calcutta and environs neighboring regions of West Bengal, India are described systematically. Seven are reported for the first time in India, and the study includes descriptions of one new species and one new form. Only 11 species of *Lepadella* have previously been reported for the Indian subcontinent, and very little is known regarding distribution. With the current study, 14 lepadellid rotifers are known from West Bengal, and 17 taxa (16 species and one form) for India. The paper includes drawings made using a camera lucida. Taxa described are: *Lepadella acuminata*, *L. aspiciata*, *L. aspida*, *L. ehrenbergii*, *L. heterostylata*, *L. imbricata*, *L. ovalis*, *L. ovalis f. larga* (new form), *L. patella*, *L. quadrifaricata*, *L. rhomboides*, *L. rhomboidula*, *L. triprojectus* (new form), and *L. tritiera*. (Lynch-Wisconsin) W 8-12210

CULTURE STUDIES ON MARINE ALGAE FROM WEST GREENLAND. III. THE LIFE

HISTORIES AND SYSTEMATIC POSITIONS OF *POGOTRICHUM FILIFORME* AND *LEPTONEMATELLA FASCICULATA* (PHAEOPHYCEAE), Institute for Sporeplanter, Copenhagen (Denmark). P. M. Pedersen. *Phycologia*, Vol 17, No 1, p 61-68, 1978. 19 fig, 25 ref.

Descriptors: \*Pogotrichum filiforme, \*Leptonematella fasciculata, \*Classification, \*Litosiphon filiformis, \*Life history studies, \*Plant morphology, Phaeophyceae, Phaeophyta, Algae, Marine algae, Cultures, Litosiphon pusillus, Pogotrichaceae, Greenland, Denmark, Plurilocular sporangia, Unicellular sporangia, Thalli, Plant growth, Sporangia, Arctic.

As part of a revision of the algal order Dictyosiphonales (Phaeophyta), the systematic positions of *Pogotrichum filiforme* (*Litosiphon filiformis*) and *Leptonematella fasciculata* were assessed through life history studies. Comparison of the species referred to as *Litosiphon filiformis* with the type species of *Litosiphon* (*L. pusillus*) shows differences sufficient to warrant resurrection of the old generic name *Pogotrichum* for this species, to be called *P. filiforme*. A new family, *Pogotrichaceae*, is proposed to classify algae of this type at the head of the brown algal system. Both *P. filiforme* and *Leptonematella fasciculata* were studied under various sets of culture conditions through several successive generations. Clones of the two species were established in culture using plants from West Greenland. In *Pogotrichum* a simple life history has been found within swarms from the plurilocular sporangia in the prostrate and erect parts of the thalli giving rise to new plants of similar morphology. Unicellular sporangia in *Leptonematella fasciculata* were found in culture for the first time, occurring only at low temperature and short day conditions. The development, morphology, and life history of *L. fasciculata* are rather similar to that of *Litosiphon filiformis*, suggesting a closer taxonomic relationship. As the genus *Litosiphon* had never before been typified, *L. pusillus* is here designated the type species. (Lynch-Wisconsin) W78-12211

EFFECTS OF THE POLYCHLORINATED BIPHENYL AROCLOR 1254 ON GROWTH, SURVIVAL, AND BONE DEVELOPMENT IN BROOK TROUT (*Salvelinus fontinalis*), Fish and Wildlife Service, Columbia, MO. National Fisheries Research Lab. W. L. Mauck, P. M. Mehrle, and F. L. Mayer. *Journal of the Fisheries Research Board of Canada*, Vol 35, p 1084-1088, 1978. 4 tab, 29 ref.

Descriptors: \*Aroclors, \*Brook trout, \*Fish eggs, \*Toxicity, Polychlorinated biphenyls, Fish physiology, Animal metabolism, Growth stages, Growth rates, Fry, Mortality, Enzymes, Biochemistry, Vitamins, Path of pollutants, Water pollution effects, \*Collagen, \*Hydroxyproline, Bioaccumulation.

Eyed eggs of brook trout were exposed to Aroclor 1254 (0.43-13 microg/l) for 10 d before hatching and the fry for 118 d after hatching. Median hatching time, egg hatchability, and sac fry survival were not affected by Aroclor 1254 concentrations greater than or equal to 1.5 microg/l, but no significant differences in growth of surviving fry were observed at the end of the 118 d exposure. Mortality occurred in fry exposed to 13 microg/l within 48 d of exposure, and after 118 d of exposure significant mortality occurred in the three highest concentrations. Biochemical constituents in brook trout fry related to growth and development were affected by Aroclor 1254. Hydroxyproline and vitamin C concentrations in sac fry (38 d old) were decreased by greater than or equal to 3.1 microg/l. Backbone development in fry exposed for 118 d was significantly altered. Collagen was significantly decreased in the backbone as

was the phosphorus concentration, while the calcium concentration increased. Hydroxyproline concentration in collagen isolated from the backbone was also decreased. The no-effect exposure concentration on backbone composition was less than 0.43 microg/l. Whole body residues in fry exposed for 118 d were 40,000 to 47,000 times the concentration in water. (EIS-Deal) W78-12236

LABORATORY EXPERIMENTS ON FEEDING, GROWTH, AND FECUNDITY OF EFFECTS OF CADMIUM ON *PSEUDODIATOMUS*, Skidway Inst. of Oceanography, Savannah, GA. G. A. Paffenhofer, and S. C. Knowles. *Bulletin of Marine Science*, Vol 28, No 3, p 574-580, 1978. 3 fig, 1 tab, 19 ref.

Descriptors: \*Cadmium, \*Reproduction, \*Copepods, Growth rates, Animal behavior, Aquatic animals, Toxicity, Water pollution effects, Environmental effects, Zooplankton, Estuarine environment, Phytoplankton, Metals, \*Tissue analysis.

The influence of cadmium on feeding, growth, and food conversion, and reproduction of the estuarine copepod *Pseudodiaptomus coronatus* was studied at Cd-concentration of 5 microg x l<sup>-1</sup>. Grazing, ingestion, growth rates, and gross efficiencies did not differ. The only detectable effect was a reduction of the daily reproductive rate to 50% of copepods not exposed to Cd. (EIS-Deal) W78-12237

137CS AND POTASSIUM IN FISH AND LITTORAL PLANTS FROM A HUMUS-RICH OLIGOTROPHIC LAKE 1961-1976, Lund Univ. (Sweden). Dept. of Radiation Physics. For primary bibliographic entry see Field 5B. W78-12238

RECHERCHES DE POLLUANTS CHIMIQUES DANS LE TISSU GRASSEUX D'UN DAUPHIN ECHOUE SUR LA COTE MEDITERRANEE (CHEMICAL POLLUTANTS IN BLUBBER TISSUE OF A DOLPHIN AGROUND ON THE MEDITERRANEAN COAST), Aix-Marseille-2 Univ. (France). Lab. de Biologie Marine. For primary bibliographic entry see Field 5B. W78-12240

THE USE OF FISH AS A BIOLOGICAL SENSOR FOR TOXIC COMPOUNDS IN POTABLE WATER, Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research. For primary bibliographic entry see Field 5A. W78-12241

EFFECTS OF A LIGNOSULFONATE-TYPE MUD ON DEVELOPMENT OF EXPERIMENTAL ESTUARINE MACROBENTHIC COMMUNITIES, Environmental Research Lab., Gulf Breeze, FL. M. E. Togatz, J. M. Ivey, H. K. Lehman, and J. L. Ogelsby. *Northeast Gulf Science*, Vol. 2, No. 1, p 35-42, 1978. 1 fig, 3 tab, 22 ref.

Descriptors: \*Drilling fluids, \*Benthic fauna, Mud, Exploration, Oil industry, Estuarine environment, Plankton, Annelids, Mollusks, Water Pollution effects, Environmental effects, Biological communities, Drilling fluids, \*Arthropods, \*Coelenterates.

Drilling mud, as used in exploratory drilling for oil offshore, affected the composition of estuarine communities that developed from planktonic lar-



vae in aquaria containing sand and flowing estuarine water. Aquaria contained: sand only; a mixture (by volume) of 1 part mud and 10 parts sand; 1 part mud and 5 parts sand; or sand covered by 0.2 cm mud. For all environments, annelids, mollusks, arthropods, and coelenterates were the numerically dominant phyla collected in a 1 mm mesh seive after eight weeks exposure. Exposure to concentrations of drilling mud reduced not only the number of individuals, but also the frequency of occurrence of macrobenthic species. Thus, the average number of annelid species in 1 part mud: 5 parts sand aquaria or in mud-covered aquaria was significantly less than in control aquaria. The average number of arthropod species per aquarium was also significantly less in the mud-covered exposure than in the control. Discharge of large quantities of drilling mud at levels tested in the laboratory could adversely affect the colonization of various substrata by benthic animals in nature. (EIS-Deal)  
W78-12243

**BIODEPOSITED TRACE METALS AND MINERAL CONTENT STUDIES OF SOME TROPICAL MARINE ALGAE,**  
Universiti Sains Malaysia, Penang. Pusat Pengajian Sains Kajiayay.  
For primary bibliographic entry see Field 5B.  
W78-12244

**SUMMARY ANALYSIS OF THE NORTH AMERICAN (U.S. PORTION) OECD EUTROPHICATION PROJECT: NUTRIENT LOADING-LAKE RESPONSE RELATIONSHIPS AND TROPIC STATE INDICES,**  
Texas Univ., at Dallas, Richardson. Center for Environmental Studies.  
W. Rast, and G. F. Lee.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 984. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-008, Jan 1978; EPA; Corvallis Environmental Research Laboratory, Oregon. 455 p, 88 fig, 41 tab, 227 ref, 2 app. 1 BA608, R803356-01-0, R-803356-01-3.

Descriptors: \*United States, \*Lakes, \*Eutrophication, \*Trophic level, \*Vollenweider models, \*Nutrients, Water quality indices, Organization for Economic Cooperation and Development, Impoundments, Hydraulic residence time, Depth, Phosphorus, Chlorophyll, Nitrogen, Secchi disks, Model studies, Forecasting, Land use, Watersheds(Basins), Nutrient removal, Lake restoration, Water pollution control, Phytoplankton, Algae, Primary productivity.

A critical review of 21 studies of enriched bodies of water in the United States has been prepared for the eutrophication program of the Organization for Economic Cooperation and Development. The reports, published separately, analyze the response of 37 lakes and impoundments and one estuary to nutrient loading. This report reviews overall relationships, with particular emphasis on evaluating the Vollenweider nutrient load-trophic state formulations based on phosphorus loading as a function of mean depth/hydraulic residence time. The Vollenweider model correlated well with trophic classifications assigned by US-OECD investigators. Good correlation was also found between phosphorus loading (normalized as to hydraulic residence time and mean depth). Phosphorus and nitrogen loads were generally within a factor of + or - 2 of loads predicted on the basis of average nutrient concentrations in the bodies of water and land use in watersheds. Relationships developed in this study can be used to predict improvement in water quality which will result from reduction of phosphorus inputs to a phosphorus-limited water body. A new trophic state index system enables water managers to calculate optimum phosphorus loadings to yield a certain chlorophyll level and water clarity. This system is based on actual vs permissible phosphorus load-

ing as defined in the Vollenweider model. (Lynch-Wisconsin)  
W78-12245

**DISTRIBUTION AND IMPORTANCE OF PHYTOPLANKTON IN THE ATCHAFALAYA BASIN,**  
Nevada Univ., Las Vegas. Dept. of Biological Sciences.

S. C. Hern, W. D. Taylor, L. R. Williams, V. W. Lambou, and M. K. Morris.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 544. Price codes: A10 in paper copy, A01 in microfiche. Publication No. EPA-600/3-78-001, Jan. 1978. 194 p, 8 fig, 9 tab, 17 ref, 1 append.

Descriptors: \*Atchafalaya Basin(LA), \*Phytoplankton, \*Distribution, \*Species composition, \*Species diversity, \*Water quality indices, Eutrophication primary productivity, Algae, Louisiana, River basins, Rivers, Bays, Lakes, Marshes, Lake Verret(LA), Pat Bay(LA), Data collections, Diversity indices, Trophic level, Abundance, Habitats, Suspended solids, Diatoms, Floral lists.

A 1974-75 study of Louisiana's Atchafalaya Basin concludes that: (1) phytoplankton play a minor role in the basin's overall productivity due to high suspended sediments concentrations; (2) phytoplankton production was nearly an order of magnitude greater in three areas studied outside the basin than within the basin; and (3) diatoms and flagellates dominated algae in the basin, while flagellates and cyanophytes dominated algae outside the basin. During the study 120 stations were samples in the Atchafalaya Basin; from 86 samples examined, 107 genera and 287 species and varieties of algae were identified. For comparison, three areas outside the basin proper were sampled: a freshwater marsh south of Morgan City, Pat Bay, and Lake Verret. Data were analyzed using various water quality indices, including Ntygaard's trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices and abundance indices. Phytoplankton production was significantly lower in inlet waters than in the rest of the basin. Diatoms (especially centric diatoms) were the most abundant algal group in the study. Dominant genera, in order, were Melosira, Cryptomonas, Oscillatoria, Skeletonema, and Nitzschia. Data are presented in an extensive appendix, and lists are given of phytoplankton occurrence and abundance by species and genera. (Lynch-Wisconsin)  
W78-12246

**PHYTOPLANKTON SAMPLING IN QUANTITATIVE BASELINE AND MONITORING PROGRAMS,**

Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 5A.  
W78-12247

**DISTRIBUTION OF PHYTOPLANKTON IN DELAWARE LAKES,**  
Environmental Monitoring and Support Lab., Las Vegas, NV.

S. C. Hern, J. W. Hilgert, V. W. Lambou, F. A. Morris, and M. K. Morris.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 697. Price codes: A03 in paper copy, A01 in microfiche. Publication No. EPA-600/3-78-027, January 1978. 33 p, 4 tab, 11 ref, 1 append.

Descriptors: \*Delaware, \*Lakes, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Ponds, Bioindicators, Algae, Distribution, Species diversity, Diversity indices, Species composition, Floral lists, Data collections, National Eutrophication Survey, Killen Pond(DE), Moores Lake(DE), Noxontown Pond(DE), Silver

Lake(DE), Williams Pond(DE), Trussum Pond(DE).

Phytoplankton species composition and abundance were determined for six Delaware lakes and ponds; in addition, trophic status was assessed by means of several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices, and abundance indices. The study was conducted in spring, summer, and fall 1973 as part of the National Eutrophication Survey. Lakes were selected on the basis of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluent, (2) surface area of at least 40 ha, and (3) hydraulic retention time of at least 30 days. Lakes surveyed were Killen Pond, Moores Lake (Pond), Noxontown Pond, Silver Lake, Williams Pond, and Trussum Pond (Moores Pond). Data are summarized by lake in an appendix containing alphabetical lists of phytoplankton species with concentrations of each by sampling date, and results of application of the indices. Nygaard's indices are based on algal groups known to be unique to eutrophic or oligotrophic waters. Palmer indices incorporate two lists of organic pollution-tolerant taxa, one with 20 genera, and one with 20 species. (Lynch-Wisconsin)  
W78-12248

**GUIDELINES FOR ZOOPLANKTON SAMPLING IN QUANTITATIVE BASELINE AND MONITORING PROGRAMS,**

Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 5A.  
W78-12249

**A MODEL FOR SOLAR RADIATION CONVERSION TO ALGAE IN A SHALLOW POND,**  
Purdue Univ., Lafayette, IN. School of Mechanical Engineering.

For primary bibliographic entry see Field 3E.  
W78-12270

**SALMONELLA SEROTYPES ISOLATED FROM THE AQUATIC ENVIRONMENT (WABASH RIVER, INDIANA, 1973-1976),**

Purdue Univ., Lafayette, IN. Dept. of Veterinary Microbiology, Pathology and Public Health.  
E. V. Morse, M. A. Duncan, and E. P. Myhrum.  
The American Journal of Veterinary Research, Vol. 39, No. 4, April 1978, p 717-719. 1 tab, 12 ref. OWRT B-076-IND(2).

Descriptors: \*Salmonella, \*Fish, \*Mussels, Water pollution effects, \*Indiana, Pollutant identification, \*Wabash River(Ind).

During 1973-1976, 833 isolations of salmonella were made from the aquatic biosphere of the Wabash River, Lafayette, Ind. Of the isolates, 643 were definitively serotyped. Salmonella typhimurium represented 34.4% of the cultures. Salmonella eimsbuettel previously had not been recognized in Ind. A total of 35 serotypes and 1 untypable group C were obtained from the aquatic samples, ie, river, river bottom sediment, fish, and mussels. Most of the isolates were presumed to be of human origin, because many samplings were made in close proximity to sewage treatment plant outfalls. During the survey period, epidemic salmonellosis had not been reported for the Lafayette-West Lafayette metropolitan area.  
W78-12272

**EXPERIMENTAL SALMONELLA INFECTIONS IN CRASSIUS AURATUS (GOLDFISH),**

Purdue Univ., Lafayette, IN. Dept. of Veterinary Microbiology, Pathology, and Public Health.  
E. V. Morse, D. E. Greenwood, E. P. Meyers, V. L. Anderson, and M. A. Duncan.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

Journal of Environmental Science and Health A 13(4), 1978, p 325-335. 2 tab, 8 ref. OWRT B-076-IND(4).

Descriptors: \*Salmonella, Salmonellosis, Water pollution effects, Pollutant identification, \*Goldfish.

*C. auratus*, the common goldfish, has been experimentally infected with *Salmonella typhimurium*, isolated from river fishes, and *S. typhimurium* var. copenhagen, cultured from a pig. Infections had a duration of at least 91 days. *Salmonellae* colonized in the viscera of the fish and were in all probability shed in their feces. Fewer of the bacteria were present in the environmental water than were present within the fish during the period of the experiment. This finding confirms that colonization and multiplication of the *Salmonella* within the fish viscera had occurred.

W78-12273

EFFECTS OF SKI AREA DEVELOPMENT AND USE ON STREAM WATER QUALITY OF THE SANTA FE BASIN, NEW MEXICO, New Mexico Univ., Albuquerque. Dept. of Biology.

For primary bibliographic entry see Field 5B. W78-12277

DYNAMIC COPPER BALANCE IN A FRESH-WATER LAMELLIBRANCH SENTINEL: EFFECTS OF SUSPENDED MATTER (IN FRENCH), Unite Enseign. Rech. Sci. Lab. Ecol. Biol. Gen., Limoges, Fr.

For primary bibliographic entry see Field 5B. W78-12283

CHARACTERISTICS OF PREDICTING SANITARY CONDITIONS OF WATER USE BY THE POPULATION IN NEW ECONOMIC AREAS IN THE EXAMPLE OF THE CENTRAL REGION OF THE BAIKAL-AMUR RAILWAY (IN RUSSIAN), Nauchno-Issledovatel'skii Inst. Gigeny, Moscow. L. S. Gurvich, Yu. V. Novikov, and S. I. Plitman. Gig Sanit (8), p 11-15, 1977.

Descriptors: \*Pollutant identification, Water quality standards, Public health, Shigella, Water pollution effects, Bacilli, Enterococci, Enteroviruses, Picornaviruses, Russian-SFSR, USSR.

Data were obtained on the sanitary conditions (presence of intestinal bacilli, enterococci, Shigella, enteroviruses) of water used by human populations in newly developed areas near the Baikal-Amur railway (Russian SFSR, USSR). Methods were formulated for predicting sanitary conditions of these waters.—Copyright 1978, Biological Abstracts, Inc. W78-12284

THE COMMON MUSSEL MYTILUS EDULIS AS AN INDICATOR OF TRACE METALS IN SCANDINAVIAN WATERS. II. LEAD, IRON AND MANGANESE, Uppsala Univ. (Sweden). Inst. of Zoology. D. J. H. Phillips. Marine Biology, Vol 46, No 2, 1978, p 147-156, 2 fig, 2 tab, 46 ref.

Descriptors: \*Environmental effects, \*Water pollution, Bioindicators, Trace elements, Iron, Lead, Manganese, Mussels, Absorption.

The indicator ability of the mussel for lead, iron and manganese was tested by considering local variations in relation to known industrial sources. Overall concentration profiles for lead and iron were similar with higher concentrations of each metal being evident in mussels from the low-salinity

regions. Concentrations of manganese followed the same trend but the trend was weaker. Manganese concentrations were also unexpectedly high in some isolated locations in comparison to those of lead and iron. It was concluded that the mussel is an effective bioindicator for lead and iron but that its indicator ability for manganese is uncertain. (Chilton-ORNL) W78-12288

BALANUS AMPHITRITE (CIRRIPEDIA: THORACICA)-A POTENTIAL INDICATOR OF FLUORIDE, COPPER, LEAD, CHROMIUM AND MERCURY IN NORTH ADRIATIC LAGOONS, Istituto di Biologia del Mare, Venice (Italy).

A. Barbaro, A. Francescon, B. Polo, and M. Bilio. Marine Biology, Vol 46, No 3, 1978, p 247-257, 1 fig, 7 tab, 48 ref.

Descriptors: \*Environmental effects, \*Water pollution, Bioindicators, Fluoride, Copper, Lead, Chromium, Mercury, Mollusks, Barnacles, Balanus amphitrite.

Results of this study showed that the barnacle used as a test animal has a high capacity to take up and retain fluoride (138 to 312 ppm dry weight), a considerable predisposition to accumulate copper (41 to 109 ppm) and lead (7.1 to 11.7 ppm) and a lower capacity for accumulation of chromium (2.10 to 3.89 ppm) and mercury (0.96 to 1.35 ppm). It was concluded that *B. amphitrite* possesses most of the characteristics considered essential for a biological indicator but that more research needs to be done in the area of response time of the barnacle to changes in environmental level. (Chilton-ORNL) W78-12289

FACTORS AFFECTING METHYL AND INORGANIC MERCURY DYNAMICS IN MUSSELS AND SHRIMP, International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.

S. W. Fowler, M. Heyraud, and J. La Rosa. Marine Biology, Vol 46, No 3, 1978, p 267-276, 5 fig, 5 tab, 26 ref.

Descriptors: \*Environmental effects, \*Water pollution, Mercury, Absorption, Mussels, Shrimp, Temperature, Methyl mercury, Bioaccumulation.

Investigations showed that methyl mercury was accumulated from both food and water to a greater extent than inorganic mercury by *Mytilus galloprovincialis* and *Lysmata seticaudata*. Small mussels tended to concentrate more mercury than larger ones. Higher temperatures tended to enhance both accumulation and elimination of mercury but the effect of temperature was relatively small. Methyl mercury was eliminated more slowly than the inorganic form by both species. Observation of mussels in their natural environment showed a more rapid metal turnover than for those observed in the laboratory. (Chilton-ORNL) W78-12291

TOXIC EFFECT OF COPPER STUDIED BY ELECTRO-CARDIOGRAM IN CARP (CYPRINUS CARPIO) (IN FRENCH), Ecole Nationale Supérieure Agronomique de Toulouse (France). Lab. de Ichtyologie Appliquée. R. Labat, A. Chatelet, and J. Kugler. Bull Soc Hist Nat Toulouse 112(1/2), p 188-198, 1976.

Descriptors: \*Toxicity, \*Carp, Electrocardiograms, \*Copper, \*Pollutant identification, Temperature, Water pollution effects.

The effect of 0.5, 1.0, and 1.5 ppm of Cu was tested in 200 carp at temperatures ranging 8-25 degrees C. ECG was taken every hour for the first 3 h, and then every 3 h. During the 1st h bradycard

dia appeared and between the 3rd and 6th h cardiac frequency stabilized but remained below initial levels. At 1.0 ppm fish survived for 48 h, but all died before the end of 72 h. ECG showed problems in conduction and repolarization which were increased with a rise in temperature.—Copyright 1978, Biological Abstracts, Inc. W78-12293

EFFECTS OF ROTENONE TREATMENT ON THE ZOOPLANKTON IN A SMALL LAKE (IN NORWEGIAN), Oslo Univ. (Norway). Dept. of Limnology.

D. Hongve. Vatten 33(1), p 39-42, 1977.

Descriptors: \*Rotenone, \*Zooplankton, \*Lakes, \*Poisons, Fish control agents, Crustaceans, Pisci- cides, Larvae, Diptera, Fish food organisms, Water pollution effects, Chaoborus-flavicans, Crustacea, Extermination, Fish, \*Norway(Southeast).

The small lake Ljogodtjern (Akershus, southeast Norway) was treated with rotenone in the autumn to give total fish extermination. Net samples of zooplankton showed that also the planktonic Crustacea were poisoned and they were nearly wiped out for several months. The planktonic larvae of *Chaoborus flavicans* (Diptera) were not affected. The next summer the number of zooplankton organisms was greater than the 2 preceding years, probably because of reduced predation by fish.—Copyright 1978, Biological Abstracts, Inc. W78-12300

THE SHORE VEGETATION OF FRIER ESTUARY, TELEMARK, SE NORWAY (IN NORWEGIAN), Bergen Univ. (Norway). Biological Station.

G. Holt. Blyttia 35(2), p 53-56, 1977.

Descriptors: \*Estuaries, \*Vegetation, \*Organic wastes, \*Algae, \*Shoreline cover, Salt marshes, Industrial wastes, Urban drainage, Urbanization, Nutrients, Chlorophyta, Cladophora, Enteromorpha, Water pollution, Algal mats, Cladophora-flexuosa, Distribution, Enteromorpha-intestinalis, Growth, Industrial, Nutrients, Phragmites-communis, Plant growth, Potamogeton-perfoliatus, Waste Zannichellia-palustris.

The Frier Estuary is situated in Telemark, southeast Norway. The salt marsh vegetation consists of *potamogeton perfoliatus*, *Zannichellia palustris* and *Phragmites communis*. The area is threatened by heavy organic pollution due to waste from industrial and urban growth. The high concentrations of plant nutrients favor growth of the green algae *Caldophora flexuosa* and *Enteromorpha intestinalis*, their algal mats now carpeting the shore and shallow water bays.—Copyright 1978, Biological Abstracts, Inc. W78-12302

MACRO-NUTRIENTS IN THE LAKE GEORGE ECOSYSTEM, Kennelsaer Polytechnic Inst., Troy, NY.

D. B. Aulenbach. Eastern Deciduous Forest Biome Memo Report No. 73-63, FWI Report No. 73-19 (1973). 13 p.

Descriptors: Aquatic environment, Abiotic environment, \*Nutrient budget, Nitrogen cycle, Phosphorus, Freshwater, Inorganic compounds, Water quality, Lakes, Ecosystems, \*Lake George(NY), New York.

Samples were secured to assess the nutrient levels in Lake George at the time of sampling and to compare these values with the concentrations observed in previous years. There appeared to be a slight increase in the orthophosphate levels in 1973

as compared with 1972. Concentrations of orthophosphate varied appreciably within 6 hours when samples over a 72 hour period, but there was no evidence of a 48 hour cycle as appeared to occur in 1972. Additional data will be secured to evaluate these variations. (Rensselaer)  
W78-12304

**EFFECTS OF BENZENE (A TOXIC COMPONENT OF PETROLEUM) ON SPAWNING PACIFIC HERRING, CLUPEA HARENGUS PALLASI,**  
National Marine Fisheries Service, Tiburon, CA. Tiburon Lab.  
J. W. Struhsaker.  
Fishery Bulletin, Vol. 75, No. 1, January 1977, p 43-49, 1 fig, 5 tab, 14 ref.

Descriptors: \*Environmental effects, \*Water pollution, Oil, Herrings, Spawning, Eggs, Larvae, Embryos, Mortality, Toxicity.

Exposure of female Pacific herring to 800 ppb benzene for 48 h just prior to spawning resulted in reduction in survival of ovarian eggs (10-25%), embryos from fertilization to hatching (26%), and embryos and larvae through yolk absorption (43%). Premature spawning and aberrant swimming behavior was observed in both sexes. Comparison of these results with those from exposing other life history stages after spawning indicates that the spawning female and ovarian eggs are the most sensitive stages. (Chilton-ORNL)  
W78-12313

**OPTIMAL SALINITY AND TEMPERATURE INTERVALS OF LIMAPONTIA CAPITATA (OPISTHOBRANCHIA, SACOGLOSSA) DETERMINED BY GROWTH AND HEART RATE MEASUREMENTS,**  
Copenhagen Univ., Helsingør (Denmark). Marine Biological Lab.  
K. Jensen.  
Ophelia, Vol. 16, No. 2, December 1977, p 175-185, 1 fig, 4 tab, 7 ref.

Descriptors: \*Environmental effects, \*Thermal pollution, Temperature, Salinity, Growth rate, Metabolism, Aquatic animals, Limapontia capitata.

Data collected in these investigations showed that *L. capitata* has an optimal temperature of about 15°C with a range of tolerance from about 0 to 38 or 40°C. Optimal salinity is approximately 30‰ although reproduction is abundant at 20 and 15‰. Death of osmotic stress occurs only at low salinities, < 5‰. The only fact indicating any interaction of temperature and salinity is that it seems as if suboptimal temperatures are best tolerated at optimal salinity and extremely low salinities are best tolerated at suboptimal temperatures. (Chilton-ORNL)  
W78-12319

**TEMPERATURE DEPENDENCE OF ACTIVE METABOLISM AND SWIMMING SPEED OF THE BAIDAL GRAYLING, THYMALLUS ARCTICUS BAICALENSIS,**  
Akademiya Nauk SSSR, Novosibirsk, Inst. of Physiology.  
A. Y. Stolbov, and Y. S. Altkin.  
Journal of Ichthyology, Vol. 17, No. 1, 1977, p 178-179, 1 tab, 7 ref.

Descriptors: \*Environmental effects, \*Temperature, Fish behavior, Metabolism, Fish, Swimming, Velocity, Baikal grayling, Thymallus arcticus baicalensis.

Experimental data showed that the standard metabolism in the grayling is subject to the usual temperature relationship with the coefficient Q<sub>10</sub> of around 2. An increase in temperatures of 4 to 12°C increases oxygen consumption in a state of

rest by 75%. During swimming the metabolism of fish increases. An absolute increase in oxygen consumption appeared to be dependent only on the intensity of work and not on temperature. The absolute increase in the rate of the total metabolism caused by temperature was almost the same at all regimes investigated and was determined primarily by the temperature dependence of the resting metabolism. It was concluded that energy expenditure on the performance of external mechanical work during swimming of the grayling does not in practice depend on water temperature. (Chilton-ORNL)  
W78-12320

**THE EFFECT OF TEMPERATURE ON THE EGG INCUBATION PERIOD OF TAENIOPTERYX NEBULOSA (PLECOPTERA),**  
Oslo Univ. (Norway). Zoological Museum.  
J. E. Brittain.  
Oikos, Vol. 29, No 2, 1977, p 302-305, 1 fig, 1 tab, 12 ref.

Descriptors: \*Environmental effects, \*Water pollution, \*Thermal pollution, Temperature, Incubation, Hatching, Embryonic growth stage, Taeniopteryx nebulosa.

Eggs of *T. nebulosa* were incubated at temperatures approximating 2, 4, 8, 12, 16, 20 and 24°C. The number of eggs/egg mass varied between 71 and 758. A linear relationship on logarithmic scales was found between water temperature (TC) and mean egg incubation period (Y days) for these temperatures. Low hatching success was observed at 2 and 24°C, indicating that these temperatures are at or near the limits of the egg stage in *T. nebulosa*. (Chilton-ORNL)  
W78-12321

**THE EFFECT OF CONSTANT AND CHANGING TEMPERATURES ON THE THERMAL RESISTANCE OF LYMNAEA PEREGRINA (MULLER),**  
Trinity Coll., Dublin (Ireland). Dept. of Zoology.  
O. A. M. Al-Habbib, and J. N. R. Grainger.  
Journal of Thermal Biology, Vol. 2, p 191-195, 8 fig, 31 ref. (1977).

Descriptors: \*Environmental effects, Temperature, Thermal stress, Mortality, Snails.

In this study, snails were acclimated to temperatures of 6.5, 11.5, and 16.5°C. Results showed that resistance of snails acclimated to 6.5°C to high lethal temperatures was greater than that of 16.5°C snails while the 11.5°C acclimated snails were intermediate. Thermal resistance of snails kept under changing temperature conditions was also intermediate between the 16.5°C and 6.5°C snails. Snails acclimated to high temperature had higher low lethal temperatures than those acclimated to low temperature. Studies of the effect of seasonal variation showed that the relation between lethal and habitat temperatures was also paradoxical. (Chilton-ORNL)  
W78-12323

**GROWTH CHARACTERISTICS OF CHLAMYDOMONAS GETTLERI,**  
Ceskoslovenska Akademie Ved, Trebon. Lab. of Biotechnology.  
K. Tetik, and J. Necas.  
Archiv fur Hydrobiologie, Vol. 51, No. 2, 1977, p 164-183, 13 fig, 34 ref.

Descriptors: \*Environmental effects, Temperature, Algae, Growth rate, Light, Laboratory investigations.

The strain of *Chlamydomonas getleri* used in these studies was found to grow well at temperatures between 4 and 28°C. It was able to grow and reproduce at a significant rate even at the temperature of 4°C but exhibited an unfavourable response

at 30°C. An optimum irradiance was found to be 30 W/sq. m. Overirradiation was tolerated at lower temperatures but not at higher ones. (Chilton-ORNL)  
W78-12324

**THE MIGRATION OF ELVERS OF ANGUILLA ANGUILLA L. IN THE MEX CANAL, ALEXANDRIA, EGYPT,**  
Alexandria Univ. (Egypt). Dept. of Oceanography.  
A. Ezzat, and S. El-Serafy.  
Journal of Fish Biology, Vol. 11, No. 3, September 1977, p 249-256, 3 fig, 8 tab, 13 ref.

Descriptors: \*Environmental effects, \*Migration, Oxygen, Temperature, Salinity, Chlorine, Hydrogen ion concentration, Seasonal, Elvers, *Anguilla anguilla*.

Assessment of the effects of hydrographic factors on the upstream migration of elvers show that favourable factors probably include low oxygen content; a pH between 7.7 and 8.0; a chlorosity value between 2.1 and 2.3 Cl/l; and temperature between 20 and 25°C. These factors interact to affect the number of elvers entering the canal. Elvers begin to arrive at the end of February, and continue to run up the Mex canal until June with the main bulk of elvers arriving in April and May. (Chilton-ORNL)  
W78-12325

**ASEXUAL PROPAGULES IN THE LIFE HISTORY OF POLYSIPHONIA FERULACEA (RHODOPHYTA, CERAMIALES),**  
North Carolina Univ. at Wilmington. Dept. of Biology.  
D. F. Kapraun.  
Phycologia, Vol. 16, No. 4, 1977, p 417-426, 21 fig, 37 ref.

Descriptors: \*Environmental effects, Temperature, Light, Algae, Growth rates, Reproduction, Genetics.

Light intensity and temperature effects on growth, sexual reproduction and propagule formation in *Polysiphonia ferulacea* were studied. More than ten generations of a North Carolina isolate and six generations of a Bermuda isolate were studied. The two isolates were fully self-fertile but unable to hybridize with each other. In cross-gradient culture experiments, both gametophytic and tetrasporophytic phases of the algae developed best at 25°C and 2040-2570 lux illumination. In general, culture conditions favouring vegetative growth and sexual reproduction also initiated propagule formation. In nature, the N. Carolina isolate was collected during all seasons but attained maximum vegetative growth and reproduction during April and May. (Chilton-ORNL)  
W78-12326

**EARLY DEVELOPMENT OF THE SOUTH AFRICAN MAASBANKER TRACHURUS TRACHURUS AT CONTROLLED TEMPERATURES,**  
Department of Industries, Sea Point (South Africa). Sea Fisheries Branch.  
D. P. F. King, M. J. O'Toole, and A. A. Robertson.  
Fisheries Bulletin of South Africa, Vol. 9, 1977, p 16-22, 5 fig, 3 tab, 12 ref.

Descriptors: \*Environmental effects, Temperature, Fish, Growth stages, Embryonic growth stage, Larvae, Horse mackerel, Maasbanker, *Trachurus trachurus*.

Egg and larval developmental rates of the maasbanker or horse mackerel were studied at ten constant temperatures ranging from 12.6 to 24.3°C. During embryonic development the incubation time to any given developmental stage decreased exponentially with increasing temperature. At 12.6°C, complete gastrulation required 36 hr. and at



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

24.3C complete gastrulation required 2 hr. The period to hatching was 84 hr at 12.6C and 20 hr. at 24.3C. Time of development from hatching to absorption of the yolk in the larvae was 5.5 days at 12.6C and 1 day at 24.3C. Maximum growth rate of resulting larvae was found at the highest temperature. (Chilton-ORNL)  
W78-12327

**'BASELINE MONITORING STUDIES, MISSISSIPPI, ALABAMA, FLORIDA, OUTER CONTINENTAL SHELF, 1975-1976' VOLUME III, RESULTS.** State Univ. System of Florida Inst. of Oceanography, St. Petersburg.  
For primary bibliographic entry see Field 7C.  
W78-12328

**MACROPARASITES OF FISH FROM EAGLE MOUNTAIN LAKE, TEXAS,** Texas Christian Univ., Fort Worth. Dept. of Biology.  
T. L. Gruening, C. E. Murphy, and J. C. Britton. The Southwestern Naturalist, Vol. 22, No. 4, October 1977, p 525-535, 1 fig, 1 tab, 41 ref.

Descriptors: \*Environmental effects, \*Thermal pollution, \*Water pollution, Powerplants, Temperature, Fish, Parasitism, Heated water.

Fish representing three families (Centrarchidae, Ictaluridae, and Sciaenidae) were collected from stations within the area of a thermal plume from a steam-electric generating power plant and from a station outside the thermal plume. A total of 32 parasite species representing 22 families and 26 genera was identified from the fish examined. Data from this study indicated that when fish are provided free access to either heated or unheated waters, the incidence of parasitism in fish collected from the two areas will be approximately similar. (Chilton-ORNL)  
W78-12329

**SALINITY, TEMPERATURE, AND GROWTH REGULATOR EFFECTS ON SEED GERMINATION OF SALICORNIA EUROPAEA L.,** Ohio Univ., Athens. Dept. of Botany.  
I. A. Ungar. Aquatic Botany, Vol. 3, 1977, p 329-335, 5 fig, 16 ref. NSF BMS 74-19435 and DEB 76-00444.

Descriptors: \*Environmental effects, Temperature, Salinity, Growth rates, Aquatic plants, Salt marshes, Germination, Seeds, Plant growth.

*Salicornia europaea* seeds were soaked for 7 days at 5C and then placed on a temperature gradient bar at temperatures of 10, 15, 20, 25, and 30C. Salinity concentrations of 0.0, 1.0, 2.0, 3.0, and 5.0% NaCl were used. Optimal seed germination occurred in distilled water treatments at 25C. Salinity increments inhibited germination at all test temperatures with treatments at 25C. Salinity increments inhibited germination at all test temperatures with treatments of 10C having the lowest germination percentages at all salinity regimes. Smallest decrease in germination from the control occurred in 1.0% NaCl at 25C. No seeds germinated in 5.0% NaCl at any temperatures. Treatment of seeds with gibberelic acid stimulated germination in salinities up to 5.0%. Kinetin solutions alone were not stimulatory to germination. (Chilton-ORNL)  
W78-12331

**THE INFLUENCE OF ABOVE-OPTIMAL CONSTANT TEMPERATURES ON SOUTH AFRICAN BIOMPHALARIA PFEIFFERI (KRAUSS) (MOLLUSCA: PLANORBIDAE),** Bilharzia Field Research Unit, Nelspruit (South Africa).  
C. C. Appleton.

Transactions of the Royal Society of Tropical Medicine and Hygiene, Vol. 671, No. 2, 1977, p 140-143, 3 fig, 7 ref.

Descriptors: \*Environmental effects, \*Thermal pollution, Temperature, Hatching growth rate, Fecundity, Snails, Biomphalaria pfeifferi.

Eggs of *B. pfeifferi* were incubated at 25 + or - 0.4C, 28 + or - 0.2C, 29 + or - 0.2C and ambient temperature (mean 22.8C). Rates of oogenesis and spermatogenesis at 25C and ambient temperature were similar but they were slightly accelerated at 27C. Fecundity and survival at 27C were considerably reduced. At 29C hyperthermia was pronounced. Oogenesis and spermatogenesis were delayed and did not reach completion, there was an increase in the number of degenerating female germinal cells and no eggs were laid. Inadequate ootestis development was coupled with retarded growth and poor survival. (Chilton-ORNL)  
W78-12332

**ADJUSTMENT OF THE COMPONENTS OF ENERGY BALANCE IN THE GASTROPOD CREPIDULA FORNICATA IN RESPONSE TO THERMAL ACCLIMATION,** Odense Univ. (Denmark). Biological Inst.  
R. C. Newell, and L. H. Kofoed. Marine Biology, Vol. 44, No. 3, 1977, p 275-286, 5 fig, 2 tab, 27 ref.

Descriptors: \*Environmental effects, \*Thermal stress, Temperature, Energy budget, Oxygen requirements, Aquatic animals, Gastropods.

Measurements were made of routine rate of oxygen consumption and clearance rate of *Phaedactylum tricornutum* by *Crepidula fornicata* which had been acclimated to temperatures of 5, 10, 15, 20, and 25C. These measurements showed that the cost of activity (micro l O<sub>2</sub> consumed/h/ml seawater cleared/h) increased in limpets exposed to short-term increases of temperature up to 30C. This increase was especially dramatic in limpets acclimated to 10C. Routine oxygen consumption shows lateral translation of the rate-temperature curve resulting in maintenance of a relatively uniform energy expenditure despite an increase in acclimation temperature from 10 to 25C. Lateral translation in response to warm acclimation results in an increase in the maximal clearance rate. It was concluded that lateral translation of the rate-temperature curves for feeding rates and for oxygen consumption in response to thermal acclimation may be linked to maintain a balance between energy gain and expenditure. (Chilton-ORNL)  
W78-12333

**SLOW, FAST- AND MEDIUM FAST RESPONSES OF ECTOTHERMS TO TEMPERATURE CHANGES: A NEW MECHANISM OF METABOLIC COMPENSATION IN HELIX POMATIA.,** Innsbruck Univ. (Austria). Inst. fuer Zoophysiology.  
W. Wieser. Journal of Thermal Biology, Vol. 2, 1977, p 197-201, 3 fig, 1 tab, 17 ref.

Descriptors: \*Environmental effects, Temperature, Snails, Metabolism, Animal physiology, Enzymes.

Results of this investigation showed that the activities of pyruvate kinase (PK) and lactate dehydrogenase (LDH) from the foot of the snail are closely correlated with each other. If V max of PK and LDH measured at 20C is plotted against the average temperature prevailing on the day of collection a clearcut negative proportionality is obtained: the higher the temperature the lower the activities of both enzymes. PK activity is perfectly temperature-compensated while LDH activity increases slightly with temperature. Phosphoarginine (PARg) inhibits PK activity suggesting a

phosphorylation/dephosphorylation mechanism. With an incubation time of 12-15 minutes, the degree of inhibition is dependent upon the concentration of PK as well as on individual features of the PK. It was suggested that interaction of PARg and PK might provide a mechanism by which rate of flow of PEP through this glycolytic branchpoint is controlled by temperature and by locomotory activity of the animal. (Chilton-ORNL)  
W78-12339

**THERMAL SHOCK TOLERANCES OF SIX FISHES AND ONE INVERTEBRATE FROM THE PACIFIC NORTHWEST,** Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Labs.  
J. W. Young, and C. W. Apts. BNWL-2289, September 1977, 8 pp, 2 tab, 9 ref.

Descriptors: \*Environmental effects, \*Water pollution, \*Thermal pollution, Temperature, Mortality, Powerplants, Cooling water, Equilibrium, Fish behavior, Fish, Effluents.

The purpose of this study was to ascertain the temperatures at which selected estuarine fishes from the Pacific Northwest and one of their potential food organism would be incapacitated and killed after entering the thermal plume of an industrial cooling system. The species tested were shiner perch, coho salmon, Pacific sand lance, threespine stickleback, silverspotted sculpin, Pacific staghorn sculpin, and mysids. Information on temperature at which equilibrium loss and death occurred is presented in tabular form for each species. Mysids did not exhibit equilibrium loss. (Chilton-ORNL)  
W78-12340

**DOWNSTREAM MOVEMENT OF FISH IN A TRIBUTARY OF SOUTHERN LAKE SUPERIOR,** Bureau of Commercial Fisheries, Marquette, MI. Sea Lamprey Control Station.  
P. J. Manion. The Progressive Fish-Culturist, Vol. 39, No. 1, January 1977, p 14-16, 1 fig, 2 tab, 6 ref.

Descriptors: \*Environmental effects, Temperature, Streamflow, Migration, Fish, Brook trout, Yellow perch, Sticklebacks, Sculpins.

The influence of stream flow and water temperature on the downstream movement of brook trout, brook sticklebacks, mottled sculpins, and yellow perch was investigated. During periods of normal water levels, brook trout and brook sticklebacks appeared to move downstream actively. The trout migrated in spring and fall at water temperatures of about 10C. Sticklebacks moved primarily in winter. Mottled sculpins apparently moved primarily during floods and may have been carried downstream passively. Yellow perch moved downstream in fall as water levels rose and temperatures decreased. (Chilton-ORNL)  
W78-12341

**THERMAL RESISTANCE OF THE CILIARY ACTIVITY IN THE GILLS OF THE FRESH WATER MUSSEL ANODONTA ANATINA,** Kiel Univ. (West Germany). Zoophysical Lab.  
K. E. O. Senius. Journal of Thermal Biology, Vol. 2, 1977, p 233-238, 6 fig, 1 tab, 10 ref.

Descriptors: \*Environmental effects, Thermal stress, Temperature, Mussels, Gills, Ciliary activity.

When intact *A. anatina* mussels were kept at a temperature of 24C, relatively rapid acclimation occurred in the thermal resistance of ciliary activity. After 2 days the resistance time of warm-acclimated mussels was higher at 39C than that of the control group kept at 14C. Thermal resistance of

cold-acclimated mussels did not differ from the control group. Resistance acclimation did not appear in isolated gills kept at 4, 14, and 24°C for 1 to 3 days. After an acclimation period of 2 days the ciliary activity in mussels kept at 24°C showed a significantly increased response to acetylcholine (ACh) at 39°C. In isolated gills, thermal resistance was enhanced by ACh, choline, and tetramethylammonium and diminished by atropine and physostigmine. It was concluded that thermal resistance control in *A. anatina* is probably neural. (Chilton-ORNL)  
W78-12342

**EFFECT OF TEMPERATURE ON THE HATCHING TIME OF EGGS OF EPHEMERELLA IGNITA (PODA) (EPHEMEROPTERA: EPHEMERELLIDAE).**  
Freshwater Biological Association, Windermere (England).  
J. M. Elliott.  
Freshwater Biology, Vol 8, 1978, p 51-58, 4 fig, 1 tab, 36 ref.

Descriptors: \*Environmental effects, \*Temperature, Hatching, Embryonic growth stage, Aquatic insects.

Eggs of *Ephemerella ignita* were incubated in the laboratory at eight constant temperatures ranging from 5.9 to 19.8°C. At temperatures of 10.0 - 14.2°C, 85% of the eggs hatched with the percentages dropping to 39% to 5.9°C and 42% at 19.8°C. Hatching time also decreased as water temperature increased from 5.9 - 14.2°C. Time for development expressed in units of degree-days above a threshold temperature showed that mean values were 552 degree-days above 4.25 for 10% of eggs hatched, 862 degree-days above 3.57°C for 50% hatched, and 1385 degree-days above 3.14°C for 90% hatched. These values were used to predict hatching times at temperatures below 14.68°C for 10% hatched, 14.54°C for 50% hatched and 14.45°C for 90% hatched. Comparison of predictions with field observations showed good agreement. (Chilton-ORNL)  
W78-12343

**AN INVESTIGATION INTO THE GROWTH OF O-GROUP ROACH, (RUTILUS RUTILUS L.) WITH SPECIAL REFERENCE TO TEMPERATURE.**  
Hull Univ. (England). Dept. of Zoology.  
N. M. Broughton, and N. V. Jones.  
Journal of Fish Biology, Vol 12, 1978, p 345-357, 3 fig, 7 tab, 42 ref.

Descriptors: \*Environmental effects, Temperature, Seasonal, Fish, Growth rates.

Growth of O-group roach in two waters (a chalked river and a gravel pit) was compared. In both habitats, a good correlation existed between measurement of warmth and growth over a wide range of temperatures, with the correlation being highest with the number of degree-days above 14°C. Water temperature, acting through the food supply, appeared to be the dominant factor affecting growth. (Chilton-ORNL)  
W78-12344

**EFFECT OF SOME ENVIRONMENTAL FACTORS ON SURVIVAL AND ACTIVITY OF FRESH WATER BIVALVE LAMELLIDENS CORRIANUS.**  
Gorakhpur Univ. (India). Dept. of Zoology.  
S. Samant, and R. A. Agarwal.  
Indian Journal of Experimental Biology, Vol 16, January 1978, p 26-28, 3 tab, 12 ref.

Descriptors: \*Environmental effects, \*Water pollution, Temperature, Salinity, Hydrogen ion concentration, Aquatic animals, Mussels, Mortality.

An investigation was made into the effect of temperature change, pH and salinity on the rhythmic activity and survival of *Lamellidens corrianus*. Rhythmic activity increased with rise in temperature from 25 to 40°C with 100% survival from 20 - 30°C. Optimum temperature for both activity and survival was between 32 and 35°C. Preferred pH was 7.9 but a wide range of pH (5.5 to 8.5) was tolerated. The blood of this bivalve was found to be hyper-osmotic and the animals preferred a hypo-osmotic environment. Activity was reduced as salinity increased from 0 - 5‰. (Chilton-ORNL)  
W78-12345

**OBSERVATIONS ON THE ECOLOGY OF CLINOSTOMUM MARGINATUM IN LARGEMOUTH BASS (MICROPTERUS SALMOIDES).**  
Wake Forest Univ., Winston-Salem, NC. Dept. of Biology.  
T. C. Hazen, and G. W. Esch.  
Journal of Fish Biology, Vol 12, 1978, p 411-420, 5 fig, 1 tab, 12 ref. ERDA No. E (38-1)-900 and (38-1)-819.

Descriptors: \*Environmental effects, \*Water pollution, \*Thermal pollution, Largemouth bass, Diseases, Animal parasites, Seasonal, Reservoirs.

A seasonal periodicity for infection percentages of *Clinostomum marginatum* among largemouth bass collected in a reservoir receiving thermal effluent was found. Percentages of 25% were observed in January to June, dropping to a low of <10% in July with a rise to 30% in September to October and then a steady decline to <10% again in December. Body condition, body length or influence of thermal effluent did not appear to be related to percentage of infection. It was suggested that the cyclic nature of the infection is probably associated with a seasonal change in density and/or size structure of snail populations, the first intermediate host for *C. marginatum*. A significant rank correlation was seen between infection percentage and the amount of littoral zone present in the area from which fish were collected. Local bay effects may be the result of limited home and foraging ranges of the bass in relation to the amounts of littoral zone present in various locations of the reservoir. (Chilton-ORNL)  
W78-12346

**RELATIONSHIP OF SEASON, THERMAL LOADING AND RED-SORE DISEASE WITH VARIOUS HAEMATOLOGICAL PARAMETERS IN MICROPTERUS SALMOIDES.**  
Wake Forest Univ., Winston-Salem, NC. Dept. of Biology.  
T. C. Hazen, G. W. Esch, A. B. Glassman, and J. W. Gibbons.  
Journal of Fish Biology, Vol 12, 1978, p 491-498, 1 fig, 6 tab, 20 ref. ERDA No. EY-76-S-09-900 and E(38-1)-819.

Descriptors: \*Environmental effects, \*Water pollution, \*Thermal pollution, Largemouth bass, Diseases, Seasonal, Animal parasites.

The blood of 150 largemouth bass collected from a cooling reservoir (equal numbers from the ambient and thermally altered areas of the reservoir) was measured for haematocrit, haemoglobin, iron, iron-binding capacity, thyroxine, sodium and potassium. The fish were examined for evidence of red-sore disease. Only the total iron-binding capacity was significantly higher in fish with red-sore disease. Bass from thermally altered areas exhibited consistently higher haematocrits in all seasons. In summer months, bass showed higher levels of circulating iron and thyroxine. It was concluded that infection with *Aeromonas hydrophila* does not elicit significant haematological changes in largemouth bass. Seasonal temperature rises and thermal loading conditions tended to lower body conditions of bass. It was noted that seasonal variability in feeding behavior and availability of

prey species may play a role in such results. (Chilton-ORNL)  
W78-12347

**LABORATORY MEASUREMENT OF PREFERRED BODY TEMPERATURE OF ADULT LARGEMOUTH BASS (MICROPTERUS SALMOIDES).**  
Oklahoma State Univ., Stillwater, School of Biological Sciences.  
B. J. Venables, L. C. Fitzpatrick, and W. D. Pearson.  
Hydrobiologia, Vol 58, No 1, 1978, p 33-36, 4 fig, 1 tab, 11 ref.

Descriptors: \*Environmental effects, Temperature, Bass, Laboratory tests, Fish behavior.

Preferred body temperature was measured in the laboratory by allowing adult bass to behaviorally thermoregulate in a horizontal temperature gradient while telemetering their body temperatures. Preferred temperature for adults was determined to be 27-32°C. This preference is similar to that previously reported for sub-adults. (Chilton-ORNL)  
W78-12348

**A CASE OF THERMAL POLLUTION LIMITED PRIMARY PRODUCTIVITY IN A SOUTHWESTERN U.S.A. RESERVOIR.**  
North Texas State Univ., Denton. Dept. of Biological Sciences.  
T. J. Stuart, and J. A. Stanford.  
Hydrobiologia, Vol 58, No 3, 1978, p 199-211, 7 fig, 4 tab, 54 ref.

Descriptors: \*Environmental effects, Powerplants, Entrainment, Productivity, Standing crop, Algae, Reservoirs.

Primary productivity, algal standing crop and organic carbon in North Lake were all conspicuously low when compared to other nearby southwestern U.S.A. reservoirs. The investigations reported in this study showed that these facts probably resulted from nutrient limitation aggravated by power plant caused evaporation and consequent dissolved solids accumulation. Precipitation of incoming dissolved nutrients such as P and N by excessively concentrated cations could be the ultimate cause of low production rather than immediate or instantaneous entrainment-linked inhibition. (Chilton-ORNL)  
W78-12349

**INCREASE IN RANGE OF TEMPERATURE TOLERANCE BY ACCLIMATION IN THE COPEPOD EURYTOMORA AFFINIS.**  
Maryland Univ., Baltimore County, Baltimore. Dept. of Biological Sciences.  
B. P. Bradley.  
The Biological Bulletin, Vol 154, No 2, April 1978, p 177-187, 5 tab, 16 ref.

Descriptors: \*Environmental effects, Temperature, Resistance, Copepods, Acclimation.

The copepod, *Eurytemora affinis*, was tested to determine its temperature tolerance. It was found that acclimation to warm temperatures for several hours or days increased temperature tolerance. Females showed higher tolerance and acclimation than males. At higher salinity (13‰ vs. 0‰), temperature tolerance was greater but acclimation was not. Acclimation to cold temperatures occurred more slowly than to hot temperatures and sexual differences at cold temperatures were less marked than for heat tolerance. Heat and cold tolerances in the same animals appeared to be positively related traits. (Chilton-ORNL)  
W78-12350

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**THERMAL EFFECTS,**  
Oak Ridge National Lab., TN. Ecological Sciences  
Information Center.  
S. S. Talmadge, and C. C. Coutant.  
Journal of the Water Pollution Control Federation,  
June 1978, p 1514-1533, 8 tab, 401 ref.

Descriptors: \*Environmental effects, \*Water pollution, \*Thermal pollution, Temperature, Reviews, Aquatic life.

This paper is a review of the 1977 literature on thermal effects to aquatic organisms. Information concerning the effects of temperature on reproduction, embryonic development, larval development, distribution, tolerance, oxygen metabolism, growth and temperature interactions with other stresses is presented in tabular form. The text of the article includes a section on site studies, producers, consumers, decomposers, diseases and beneficial uses. (Chilton-ORNL)  
W78-12351

**THE INFLUENCE OF IONIC CONCENTRATION ON POPULATION PARAMETERS, DEVELOPMENT TIME, ACTIVITY, AND RESPIRATION RATE OF ARCTODIAPTOMUS SPINOSUS (DADAY) (CALANOIDA, COPEPODA),**  
Oesterreichische Akademie der Wissenschaften, Vienna. Limnologisches Inst.  
P. Newrkla.  
Oecologia, Vol 33, No 1, 1978, p 87-99, 7 fig, 6 tab, 37 ref.

Descriptors: \*Environmental effects, \*Population, Zooplankton, Alkalinity, Temperature, Standing crop, Respiration.

This study entailed an investigation into the population dynamics of *A. spinosus* in a small temporary pool. Significant correlations were found between population parameters and alkalinity and temperature. For birth rate, 43.33% of variance was accounted for by the influence of alkalinity and 56.33% by combined alkalinity and temperature. 48.22% of the observed variances in nauplii hatching were accounted for by alkalinity and 70.23% by alkalinity and temperature. Individual activity was not affected by differences in alkalinity within the normal range of concentration when sufficient time was allowed for adaptation. Although ionic concentration did not appear to influence embryonic development, significant increases in time of development of nauplii and of copepodites were observed at both low and high ionic concentrations. Lowest respiration rates occurred at an alkalinity of 100 meq/l. (Chilton-ORNL)  
W78-12352

**HISTOPATHOLOGICAL AND PHYSIOLOGICAL RESPONSES OF FUNDULUS HETEROCLOTUS TO NAPHTHALENE EXPOSURE,**  
Delaware Univ., Newark. Coll. of Marine Studies.  
L. DeMichele, and M. H. Taylor.  
Journal of the Fisheries Research Board of Canada, Vol 35, p 1060-1066, 1978, 3 fig, 3 tab, 22 ref.

Descriptors: \*Toxicity, \*Fish physiology, Organic compounds, Absorption, Animal metabolism, Fish diseases, Animal pathology, Radioactivity techniques, Aromatic compounds, Industrial wastes, Path of pollutants, Mortality, Oil, Oil spills, \*Mummichogs, \*Naphthalenes, Histology, Tissue analysis, Bioaccumulation, \*Cortisol.

Mummichogs were exposed to naphthalene concentrations ranging from 30 to 0.002 mg/l over time periods ranging from 1 to 15 d. Histopathology of exposed animals was evaluated. Major effects were found in the brain, liver, and pancreas down to 0.2 mg/l for a 15-d exposure. The results of these experiments indicate that the toxicity of

naphthalene in this fish is due primarily to its effect on blood components. There was also evidence of neurosensory damage at exposures as low as 0.02 mg/l for 15 d. In addition, serum glucose, protein, and cortisol were measured in animals exposed to low levels of naphthalene for 15 d. All were significantly elevated, indicating metabolic stress at exposures as low as 0.02 mg/l. 14C-naphthalene uptake was measured at two concentrations of naphthalene. Naphthalene was found to accumulate in significant amounts in organs most susceptible to pathology. The distribution of naphthalene was found to be independent of its water concentration in all organs tested except the spleen. (EIS-Deal)  
W78-12353

**EFFECTS OF AN ORGANOPHOSPHOROUS INSECTICIDE ON THE CHOLINESTERATIC ACTIVITIES OF BUFO ARENARUM (H),**  
San Luis Univ. (Argentina). Lab. of Pharmacology.  
J. A. Guzman, and T. Guardia.  
Bulletin of Environmental Contamination and Toxicology, Vol 20, p 52-58, 1978, 4 tab, 9 ref.

Descriptors: \*Toxicology, \*Insecticides, \*Organophosphorous pesticides, \*Toads, Animal metabolism, Seasonal, Amphibians, Animal physiology, Path of pollutants, Pesticide toxicity, Biochemistry, Enzymes, \*Parathion, Bufo, Tissue analysis.

This research involves the survival and modification of cholinesteratic activity in a Parathion fumigated medium. In both exposed groups the plasma cholinesteratic activity was decreased. Cholinesteratic activity is quickly recovered when the toads are transferred to a Parathion-free medium. In summer the cholinesteratic activity is usually higher than in winter. The higher significant difference is observed in liver tissue. (EIS-Deal)  
W78-12354

**REDUCTION OF HEAVY METAL TOXICITY TO XENOPUS EMBRYOS BY MAGNESIUM IONS,**  
Vermont Univ., Burlington. Dept. of Zoology.  
J. C. Miller, and R. Landesman.  
Bulletin of Environmental Contamination and Toxicology, Vol 20, p 93-95, 1978, 1 tab, 6 ref.

Descriptors: \*Magnesium, \*Manganese, \*Lead, \*Cadmium, \*Toxicity, Metals, Heavy metals, Animal metabolism, Growth stages, Embryonic growth stage, Biochemistry, Animal physiology, Growth rates, Animal pathology, \*Xenopus.

The data demonstrates the ability of magnesium ions to moderate the toxicity of lead, cadmium and manganese ions. Since the magnesium content of *Xenopus* embryos is constant regardless of environmental levels, this suggests that there may be competition occurring for some common carrier mechanism which transports divalent cations into the embryos. Similar mechanisms have been shown to exist in microorganisms. (EIS-Deal)  
W78-12356

**A PRELIMINARY STUDY OF THE EFFECTS OF DIFLUBENZURON AND METHOPRENE ON RAINBOW TROUT (SALMO GAIARDNERI) RICHARDSON,**  
Manitoba Univ., Winnipeg. Dept. of Entomology.  
D. J. Madder, and W. J. Lockhart.  
Bulletin of Environmental Contamination and Toxicology, Vol 20, p 66-70, 1978, 3 tab, 19 ref.

Descriptors: \*Growth rates, \*Rainbow trout, \*Toxicity, Organic compounds, Fish physiology, Animal metabolism, Environmental effects, Path of pollutants, Biochemistry, Chemical analysis, Pesticide toxicity, Water pollution sources, Insecticides, \*Insect growth regulators, \*Methoprene, \*Diflubenzuron.

Recent research has shown insect growth regulators to be environmentally less objectionable than many older insecticides. Diflubenzuron and Methoprene are two insect growth regulators which are expected to be used on a large scale within the next few years. However, exposure of non-target organisms is inevitable. In this experiment, the effect of Diflubenzuron and Methoprene on rainbow trout blood serum chemistry was analyzed. Increasing concentrations of Diflubenzuron were associated with decreasing serum GOT levels. During exposure to Methoprene the rainbow trout became visibly lethargic in comparison to the control fish. Values for hematocrit, lipid, glucose, and sodium are also presented. (EIS-Deal)  
W78-12357

**PATTERNS OF TRACE METAL ACCUMULATION IN CRAYFISH POPULATIONS,**  
Northern Illinois Univ., De Kalb. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5B.  
W78-12358

**MERCURY CONCENTRATIONS IN PACIFIC HAKE, MERLUCCIIUS PRODUCTUS (AYERS), AS A FUNCTION OF LENGTH AND LATITUDE,**  
Oak Ridge National Lab., TN.  
For primary bibliographic entry see Field 5B.  
W78-12359

**UPTAKE OF GLYCOLIC ACID BY A MARINE BIVALVE,**  
Florida State Univ., Tallahassee. Dept. of Oceanography.  
D. A. DiDomenico, and R. L. Iverson.  
Journal of Experimental Marine Biology and Ecology, Vol. 28, p 243-254, 1977, 1 tab, 4 fig, 47 ref.

Descriptors: \*Clams, \*Mollusks, \*Metabolism, \*Biochemistry, \*Kinetics, \*Energy transfer, Carbon radioisotopes, Invertebrates, Animal physiology, Absorption, Laboratory tests, Nutrient removal, Nutrients, Energy equation, \*Glycolic acid, \*Gills, \*Tissue analysis, \*Nutrient sources.

Glycolic acid is accumulated by in vitro preparations of gill tissue from the quahog clam, *Merccenaria* sp., by a process indicating diffusion kinetics. Carbon-14 from labelled glycolic acid was found in the lipid fraction of the gill tissue. Evolution of labelled carbon dioxide suggests that the glycolic acid is metabolized in gill tissue. (EIS-Katz)  
W78-12361

**TEMPERATURE ACCLIMATION IN ACTINIA EQUINA L. (ANTHOZOA),**  
Natal Univ., Pietermaritzburg (South Africa). Dept. of Zoology.  
R. J. Griffiths.  
Journal of Experimental Marine Biology and Ecology, Vol. 28, p 285-292, 1977, 4 fig, 17 ref.

Descriptors: \*Water temperature, \*Heated water, \*Invertebrates, \*Intertidal areas, \*Animal physiology, \*Feeding rates, Temperature, Salinity, Reproduction, Environmental effects, Mortality, Stress, Seasonal, Laboratory tests, Distribution patterns, \*Actinia equina, \*Thermal stress, \*South Africa, \*Anemones, \*Acclimation.

Respiratory adaptation to different sea temperatures on the Natal (east) and Table Bay (west) coasts of southern Africa demonstrated in *Actinia equina*. Animals are able to acclimate to lower sea temperatures but are unable to adapt to an increase of 3C or more above summer sea temperatures. Acclimation to elevated water temperatures may be limited by thermal sensitivity of the tissues



# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Effects Of Pollution—Group 5C

and by lack of feeding when under thermal stress. The successful colonization of the Natal littoral zone by *A. equina* may be attributed partially to metabolic adaptability but also to its brooding ability, tolerance of desiccation, and capacity to retain water within the coelenteron. Slow exudation of this water enables evaporative cooling of the tissues during low tide. Other actinian species from Natal lack this range of features and are hence limited to damp habitats at lower tidal levels. (EIS-Katz)  
W78-12362

**SUPPRESSION OF CORAL POPULATIONS BY FILAMENTOUS ALGAE WITHIN DAMSELFISH TERRITORIES.**  
Australian National Univ., Canberra (Australia). Dept. of Environmental Biology.  
D. C. Potts.  
Journal of Experimental Marine Biology and Ecology, Vol. 28, p 207-216, 1977. 1 fig, 1 tab, 31 ref.

Descriptors: \*Growth rates, \*Marine fish, \*Coral, \*Biological communities, Environmental effects, \*Grazing, \*Sediments, \*Fish behavior, Benthic fauna, Aquatic animals, Marine animals, Invertebrates, Mortality, Metabolism, Aquatic populations, Sediments, Aquatic habitats, Seasonal, \*Acropora, \*Dischistodus, \*Damselfish, \*Territories.

Transplanted pieces of the coral *Acropora palifera* simulating colonies 2-4 years old were adversely affected by dense algal-sediment mats developed in response to reduced grazing pressures within territories of the damselfish. Coral growth was initially prolonged in autumn, but was subsequently suppressed during winter and spring. There was heavy mortality only in mid-winter when corals died rapidly from the base. It is suggested that the algal mat caused the corals to expend energy to keep their surfaces clean, so that death followed the exhaustion of metabolic reserves during periods of minimum nutrient availability, and that the abundance of *D. perspicillatus* is sufficient to explain the paucity of small *Acropora palifera* colonies in an otherwise favorable habitat. (EIS-Katz)  
W78-12363

**GROWTH OF THREE PLANKTON DIATOM SPECIES IN OSLOFJORD WATER IN THE ABSENCE OF ARTIFICIAL CHELATORS.**  
Oslo Univ. (Norway). Dept. of Marine Biology and Limnology.  
E. Paasche.  
Journal of Experimental Marine Biology and Ecology, Vol. 29, p 91-106, 1977. 2 tab, 7 fig, 32 ref.

Descriptors: \*Plankton, \*Diatoms, \*Growth rates, \*Chelation, \*Succession, \*Aquatic populations, Laboratory tests, Environmental effects, Methodology, Water quality, Nutrients, Aquatic microorganisms, Seasonal, Phytoplankton, Biological communities, \*Skeletonema, \*Thalassiosira, \*Lauderia, \*EDTA, \*Oslofjord (Norway), \*Species succession.

Cultures of the plankton diatoms *Skeletonema*, *Thalassiosira*, and *Lauderia* were grown in seawater samples collected in the inner Oslofjord on 11 occasions between February 1976 and January 1977. The growth experiments were carried out in silicone-coated culture flasks, with nitrate, phosphate, and silicate added in excess, and under standardized conditions of a temperature of 10°C and a saturating light intensity. Growth rates, as measured during exponential growth over a period of 5-6 days, were, with very few exceptions, close to the maximum rates obtained in a complete medium. The addition of ethylenediaminetetraacetic acid (EDTA) to the water samples did not lead to improved growth, nor did EDTA have an effect on the initial lag phase. The lack of a

seasonal variation in the observed growth responses was in marked contrast to the large fluctuations in the phytoplankton populations in the fjord. These findings give no support to the hypothesis that species successions among marine plankton diatoms are influenced by organic chelators or other extracellular substances produced by planktonic algae. (EIS-Deal)  
W78-12364

**TOXICOLOGICAL AND PHYSIOLOGICAL ASPECTS OF THE ACTION OF HERBICIDE, SODIUM SALT OF 2,4-D ON ASELLUS AQUATICUS L. (ISOPODA).**  
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.  
D. Zimakowska-Gnoinska.  
Polskie Archiwum Hydrobiologii, Vol. 24, No. 3, p 389-411, 1977. 8 fig, 3 tab, 76 ref.

Descriptors: \*2,4-D, \*Pesticide toxicity, \*Isopods, Herbicides, Pesticides, Animal physiology, Toxicity, Mortality, Oxygen demand, Respiration, Carbon dioxide, Water pollution effects, Mode of action, Animal behavior, Persistence, Water analysis.

Sodium salt of 2,4-D, 24h-C50 and 48h-C50 concentrations tested on *A. aquaticus* were 1.07 and 0.53 g/l, respectively. An important aspect of this poison is its prolonged action, coefficient T of poison persistence is less than 1. The mortality of animals exposed to 0.17-5.00 mM solutions for 24 h and subsequently transferred to pure water was 100% after 150 days in pure water. The oxygen consumption changes under the herbicide influence in different ways, being the highest in 5 mM solution. Herbicide caused increased CO<sub>2</sub> excretion, which was the highest in 5 mM solution. (EIS-Deal)  
W78-12365

**THE EFFECT OF SODIUM SALT OF 2,4-D ON OXYGEN CONSUMPTION OF MISGURNUS FOSSILIS L. DURING EARLY EMBRYONIC DEVELOPMENT.**  
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.  
R. Z. Klekowski, B. Korde, and M. Kaniewska-Prus.  
Polskie Archiwum Hydrobiologii, Vol. 24, No. 3, p 413-421, 1977. 4 fig, 1 tab, 30 ref.

Descriptors: \*2,4-D, \*Oxygen demand, \*Pesticide toxicity, Oxygen requirement, Respiration, Fish physiology, Fish reproduction, Embryonic growth stage, Herbicides, Pesticides, Water pollution effects, Path of pollutants, Fish eggs, Toxicity, Mortality, \*Loach, *Misgurnus*.

The effect of sodium salt of 2,4-D on the oxygen consumption during early embryogenesis in eggs of loach was studied. Investigations covered the period from fertilization till the completion of gastrulation (18th hour of development). Addition of herbicide after 4 h to the developing eggs did not change the oxygen consumption as compared with control. If eggs were fertilized in water and subsequently transferred to a herbicide solution, then the inhibitory effect of this compound on the oxygen consumption manifested itself after 9 h. On the other hand, if the egg fertilization took place in a 15 mM solution of herbicide, the inhibition of respiration began as early as after 7 h. (EIS-Deal)  
W78-12366

**RATES OF MORTALITY, GROWTH AND BIOMASS PRODUCTION OF LYMNAEA PALUSTRIS DURING CHRONIC EXPOSURE TO LEAD.**  
Canada Centre for Inland Waters, Burlington (Ontario).  
U. Borgmann, O. Kramar, and C. Loveridge.  
Journal of the Fisheries Research Board of Canada, Vol. 35, p 1109-1115, 1978. 6 fig, 7 ref.

Descriptors: \*Lead, \*Mortality, \*Growth rates, \*Snails, Toxicity, Biomass, Growth stages, Analytical techniques, Statistical methods, Absorption, Water analysis, Chemical analysis, Spectrophotometry, Reproduction, Tissue analysis.

*Lymnaea palustris*, a freshwater snail, was exposed to lead in a continuous-flow system from newly laid eggs until reproductive maturity. Lead, at concentrations as low as 19 microg L<sup>-1</sup>, caused a significant increase in the mortality rate, although the growth rate was not affected. The lead-induced mortality was proportional to the lead concentration raised to the exponent 2.5. The mortality rate, unlike the percent mortality, is independent of time and can be combined directly with the growth rate to estimate the biomass production rate. A 50% drop in the rate of biomass production was observed at 36 microg L<sup>-1</sup> and a drop to 0 production at 49 microg L<sup>-1</sup>. Lead uptake in whole snails was found to be proportional to the lead concentration in the water, giving a concentration factor of 8500 on a dry weight basis. (EIS-Deal)  
W78-12368

**DEVELOPMENT OF A RAPID FISH TOXICITY TEST UTILIZING A FREEZE CONCENTRATION TECHNIQUE FOR ROUTINE PETROLEUM REFINERY WASTEWATER MONITORING.**  
Imperial Oil Ltd., Toronto (Canada).  
For primary bibliographic entry see Field 5A.  
W78-12369

**COMPOUNDS TOXIC TO FISH IN PULP MILL WASTE STREAMS.**  
British Columbia Research Council, Vancouver.  
J. M. Leach, and A. N. Thakore.  
Progress in Water Technology, Vol 9, p 787-798, 1977. 8 tab, 26 ref.

Descriptors: Pulp wastes, \*Toxicity, \*Resins, \*Organic acids, Industrial wastes, Water pollution sources, Chemical wastes, Pulp and paper industry, Wood wastes, Chemical analysis, Pollutant identification, Waste water identification, Waste water treatment, Rainbow trout, Sockeye salmon, Organic compounds, Resin acids, Kraft pulping wastes, Sulphite pulping, Mechanical pulping, Wood debarking, Chlorolignins, Abietic acid.

The major toxic factors in effluents from Canadian softwood kraft, sulphite and mechanical pulping operations, and in wood debarking effluents, were seven resin acids; dehydroabietic, abietic, isopimaric, palustric, primario, sandaracopimaric, and neoabietic. Contributions of the identified materials to effluent toxicity are described in terms of the toxic units concept. The toxicants are discussed in relation to their origin, to effluent discharge regulations, and to the choice of effluent treatment techniques. (EIS-Deal)  
W78-12370

**EFFECT OF INSECTICIDES: CHLORPHENVINPHOS, CARBARYL AND PROPOXUR ON AQUATIC ORGANISMS.**  
Wroclaw Technical Univ. (Poland). Inst. of the Environment Protection Engineering.  
B. Lejczak.  
Polskie Archiwum Hydrobiologii, Vol 24, No 4, p 583-591, 1977. 5 tab, 18 ref.

Descriptors: \*Pesticide toxicity, Insecticides, Toxicity, Bacteria, Algae, Protozoa, Crustaceans, Daphnia, Sphaerotilus, Pesticides, Organic compounds, Animal physiology, Water pollution effects, Biomass, Growth rates, Inhibitors, Mortality, Trophic level, \*Chlorophenphos, \*Carbaryl, \*Propoxur.

Studies were carried out on the toxic effect of the insecticides Chlorphenvinphos, Carbaryl (Sevin) and Propoxur on representatives of: filamentous

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

bacteria, algae, protozoans, crustaceans, and fish. The chemical compounds under examination had a strong toxic effect on tested organisms. The effect was the strongest in the case of fish and the weakest in the case of bacteria. Chlorophenolphos had the most poisonous effect on fish, whereas Carbaryl and Propoxur had the strongest effect on protozoans and crustaceans. (EIS-Deal)  
W78-12372

**EXPERIMENTAL TREATMENT OF WASTE EFFLUENT FROM CHEMICAL PLANTS 'POLICE' BY USING IT IN CARP CULTURES,** Wyszka Szkoła Rolnicza, Szczecin (Poland). Dept. of Hydrozoology.  
For primary bibliographic entry see Field 5D.  
W78-12373

**SOME REMARKS ON NITROGEN EXCRETION BY FISH,** Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.  
Z. Fischer.  
Polskie Archiwum Hydrobiologii, Vol 24, No 3, p 355-360, 1977. 2 fig, 1 tab, 19 ref.

**Descriptors:** \*Nitrogen compounds, \*Fish physiology, Animal metabolism, Ammonia, Urea, Animal growth, Weight, Size, Carp, Biochemistry, Proteins, Amino acids, Organic compounds, Nutrients, Growth rates, Eels.

This is a survey paper discussing quantitative aspects of excretion of common nitrogen compounds (ammonia, urea, total nitrogen) by fish in various feeding conditions and as dependent on body weight. Excretion of ammonia seems to be an index of condition of fish. Well fed and rapidly growing fish excrete a greater percentage of nitrogen in form of ammonia than fish in poor condition. (EIS-Deal)  
W78-12374

**EFFECT OF ONISCUS ASELLUS FEEDING ON BACTERIAL AND NEMATODE POPULATIONS OF SEWAGE SLUDGE,** State Univ. of New York at Syracuse. Dept. of Forest Zoology.  
B. A. Brown, B. L. Swift, and M. J. Mitchell.  
Oikos, Vol 30, p 90-94, 1978. 4 tab, 20 ref.

**Descriptors:** \*Isopods, \*Trophic level, \*Activated sludge, Population, Bacteria, Nematodes, Sewage sludge, Animal populations, Respiration, Biodegradation, Animal behavior, Invertebrates, Municipal wastes, Decomposing organic matter, Tissue analysis.

Feeding by the terrestrial isopod, *Oniscus asellus*, affected the densities of bacterial and nematode populations of activated sludge. Total bacteria, viable bacteria, nematodes and respiration generally increased after the uncatenated sewage sludge was ingested and expelled as feces. This stimulatory effect of isopod feeding may have been influenced by trophic interactions between the nematodes and their bacterial food source. (EIS-Deal)  
W78-12375

**RECENT ADVANCES IN FISH TOXICOLOGY -- A SYMPOSIUM.** Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 500. Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Agency, Ecological Research Series, Report EPA 600/3-77-085, July 1977, 203 p.

**Descriptors:** Methodology, \*Toxicity, \*Bioassay, Laboratory studies, Laboratory investigations, Supersaturation, Freshwater fish, Pesticides, Herbicides, Environment, Water pollution effects,

Path of pollutants, Chlorine, Bass, Fish physiology, Behavior, Hydrogen ion concentration, \*Copper, \*Nitrites.

The papers contained in this report were presented at the symposium—Recent Advances in Fish Toxicology—held in Corvallis, Oregon on January 13-14, 1977. The Corvallis Environmental Research Laboratory, U.S. Environmental Protection Agency and the Oregon State University Department of Fisheries and Wildlife cosponsored the symposium to encourage the rapid communication of recent findings among fish toxicologists. The symposium was dedicated to Professor Peter Doudoroff on his retirement from a long and active research and teaching career. 11 papers are included in the Symposium. (See also W78-12377 thru W78-12387) (EIS-Katz)  
W78-12376

**A MULTIPLE APPROACH TO SOLVING THE GAS SUPERSATURATION PROBLEM,** Corvallis Environmental Protection Agency. Western Fish Toxicology Station.  
R. R. Garton, and A. V. Nebeker.  
In: Recent Advances in Fish Toxicology, Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, July 1977, p 4-19. 1 tab, 4 fig, 28 ref.

**Descriptors:** \*Supersaturation, \*Columbia River, Mortality, Bioassay, Laboratory tests, \*On-site investigations, Fish behavior, Water temperature, Depth, Environmental effects, Engineering, Entrainment, \*Dams, Sockeye salmon, Fish pathology, Chinook salmon, Rainbow trout, Juvenile fish, Fish migration, Supersaturation, \*Snake River, Depth compensation.

Gas supersaturation of water was first recognized as a serious problem in the Snake and Columbia rivers of the Pacific Northwest. To solve the problem, a multiple approach was used combining laboratory and field studies to determine sources, effects, persistence, and prevention of supersaturation. Classical bioassays were used to determine effect, but additional tests were needed because of the unique nature of supersaturation. These tests included assessment of avoidance capability of fishes, assessment of depth compensation and temperature effects, and field surveys of aquatic organisms distribution in the affected areas. Data from the combined approaches were used to set safe levels for aquatic organisms. In addition, engineering expertise from other groups was applied in an attempt to prevent or mitigate the effects of supersaturation. (See also W78-12376) (EIS-Katz)  
W78-12377

**EFFECTS OF KEPONE ON ESTUARINE ORGANISMS,** Environmental Research Lab., Gulf Breeze, FL.  
D. J. Hansen, D. R. Nimmo, S. C. Schimmel, G. G. Walsh, and A. J. Wilson, Jr.  
In: Recent Advances in Fish Toxicology, Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, July 1977, p 20-30. 4 tab, 1 fig, 14 ref.

**Descriptors:** \*Insecticides, \*Pesticides, Mortality, \*Bioassay, Toxicity, Laboratory test, Estuarine environment, Estuarine fisheries, Marine fish, \*Marine algae, Mollusks, Crustaceans, Growth, Shrimp, Crabs, Methodology, Juvenile fish, \*Bioconcentration factor, \*Kepone, \*Mysids, Sheepshead minnows, Chronic bioassays.

Laboratory toxicity tests were conducted to determine the effects and accumulations of Kepone in estuarine algae, mollusks, crustaceans, and fishes. Nominal Kepone concentrations calculated to decrease algal growth by 50% in static bioassays lasting seven days were: 350 microg/l, *Chlorococcum* sp., 580 microg/l, *Dunaliella tertiolecta*; 600 microg/l, *Nitzschia* sp.; and 600 microg/l, *Thalassiosira pseudonana*. Measured Kepone concentra-

tions calculated to cause 50% mortality in flowing-seawater toxicity tests lasting 96 hours were: 10 microg/l for the mysid shrimp; 120 microg/l for the grass shrimp; greater than 210 microg/l for the blue crab; 70 microg/l for the sheepshead minnow; and 6.6 microg/l for the spot. Bioconcentration factors (concentration in whole animals divided by concentration measured in water) in these tests were greatest for fishes (950 to 1,900) and less for grass shrimp (420 to 930). Survival, growth, and reproduction of mysids and sheepshead minnows were decreased in chronic bioassays lasting 14 to 64 days. Growth of mysids and sheepshead minnows was reduced by exposure to 0.07 microg/l and 0.08 microg/l respectively. Bioconcentration factors for sheepshead minnows in the chronic bioassay averaged 5,200 (range, 31,00-7,000) for adults exposed for 28 days and 7,200 (3,600-20,000) for juveniles exposed for 36 days. The chronic toxicity and bioconcentration potential of Kepone are more important factors than its acute toxicity in the laboratory evaluations of environmental hazard. (See also W78-12376) (EIS-Katz)  
W78-12378

**COLLAGEN METABOLISM IN FISH EXPOSED TO ORGANIC CHEMICALS,** Fish and Wildlife Service, Columbia, MO. Fish Pesticide Research Lab.  
F. L. Mayer, P. M. Mehrle, and R. A. Schoettger.  
In: Recent Advances in Fish Toxicology, Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, June 1977, p 31-54. 4 tab, 7 fig, 41 ref.

**Descriptors:** \*Polychlorinated biphenyls, \*Aroclor, Pesticides, Insecticides, Toxicity, Herbicides, Chlorinated hydrocarbon pesticides, Bioassay, Toxicity, Mortality, Fish physiology, Biochemistry, \*Pathology, Rainbow trout, Brook trout, Channel catfish, \*Toxaphene, \*Aroclor 1254, Phenoxyacetic acid, Di-2-ethylhexylphthalate, Chlorinated camphene, Metabolism, Chronic toxicity metabolism, \*Collagen.

One major function of collagen is to serve as the structural support for bones. Fish grow throughout life and the vertebrae were assumed to enlarge and elongate in proportion to growth. The synthesis of vertebral collagen and hydroxyproline was examined as an indicator of growth, and as a sensitive predictor of the chronic effects of toxaphene, Aroclor 1254, the dimethylamine salt of 2,4-D, and di-2-ethylhexyl phthalate. Rainbow Trout (*Salmo gairdneri*), brook trout (*Salvelinus fontinalis*), fathead minnows (*Pimephales promelas*), and channel catfish (*Ictalurus punctatus*) were the species tested in chronic toxicity experiments, and collagen was reduced by all four chemicals. Interpretation of collagen synthesis data required information on vitamin C distribution in liver and bone since the vitamin is involved in the hydroxylation and detoxification of organic chemicals in liver and of collagen synthesis in bone. Toxaphene reduced the vitamin C content of vertebrae in channel catfish, but vitamin C content in the liver remained constant or showed a slight increase. The reduction of vitamin C in bone is thought to inhibit collagen formation. Within limits, collagen synthesis can be interpreted as a sensitive indicator and predictor of fish growth. (See also W78-12376) (EIS-Katz)  
W78-12379

**EFFECTS OF SHORT-TERM EXPOSURES TO TOTAL RESIDUAL CHLORINE ON THE SURVIVAL AND BEHAVIOR OF LARGEMOUTH BASS (MICROPTERUS SALMOLIDES),** Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.  
G. L. Larson, and D. A. Schlesinger.  
In: Recent Advances in Fish Toxicology, Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, July 1977, p 55-70. 1 tab, 5 fig, 9 ref.

## Effects Of Pollution—Group 5C

**Descriptors:** \*Methodology, \*Bioassay, Mortality, Laboratory tests, \*Toxicity, \*Chlorine, Bass, Powerplants, Fish behavior, Laboratory tests, Laboratory equipment, Chlorination, \*Acute toxicity, Survival, Largemouth bass, \*Sublethal exposure.

Largemouth bass were subjected to short-term exposures of total residual chlorine. Two different time-toxicant concentration curves similar to those of chlorinated discharges from power generation plants were used as models for the tests. Acute toxicity tests included a comparison of the effects of square and spike exposures and comparative tests of the effects of square exposures of varying frequency and duration. Fish behavior was observed during acute and sublethal square and spike exposures. There were no obvious differences in acute toxicity between the two types of exposures when mortality (in probits) was plotted against the areas under the time-concentration curves. The same results were obtained in tests of one and two 90- and 150-min. exposure. Thus, measurement of the areas under the time-concentration curves are a useful means of studying effects of different kinds and durations of exposures and different exposure frequencies. Bass exhibited several behavioral changes during the acute toxicity tests. Many behavioral responses occurred in sublethal tests of square and spike exposures. The behavioral changes caused by acute and sublethal exposures probably are detrimental to the well-being and survival of the fish in the field. (See also W78-12376) (EIS-Katz) W78-12380

**AN APPROACH FOR STUDYING THE EFFECTS OF MIXTURES OF ENVIRONMENTAL TOXICANTS ON WHOLE ORGANISM PERFORMANCES,**  
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.  
C. F. Muska, and L. J. Weber.

In: Recent Advances in Fish Toxicology, Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, July 1977, p 71-87. 2 fig, 19 ref.

**Descriptors:** \*Copper, \*Nickel, \*Metals, Laboratory tests, Laboratory equipment, \*Methodology, Mortality, Bioassay, Toxicity, Laboratory animals, Growth, Foods, Water pollution effects, Environment, Mathematical studies, Mathematical models, \*Guppies, \*Toxicant mixtures, Toxicant interactions, Quantal responses.

An extensive methodology has been developed to evaluate the toxicity of individual environmental pollutants for a variety of test animals; however, an approach is needed to study the possible interactions of toxicants found together in the environment. A promising model has previously been proposed for predicting quantal (all or none) responses or organisms to mixtures of two or more toxicants. In our laboratory, toxicity studies using the common guppy, *Poecilia reticulata*, as a test organism have demonstrated the utility of this model for predicting their lethal response to a variety of toxicant mixtures. The usefulness of this approach to environmental toxicity problems is evaluated in terms of its applicability to sublethal studies. The model under investigation and results from experiments studying the effects of copper, nickel, and their mixtures on the gross growth efficiency, relative growth rate, and food consumption of guppies are discussed. (See also W78-12376) (EIS-Katz) W78-12381

**RELATIONSHIP BETWEEN PH AND ACUTE TOXICITY OF FREE CYANIDE AND DISSOLVED SULFIDE FORMS TO THE FATHEAD MINNOW,**  
Minnesota Univ., St. Paul. Dept. of Enterology, Fisheries, and Wildlife.  
S. J. Broderius, and L. L. Smith, Jr.

In: Recent Advances in Fish Toxicology, Environmental Protection Agency, EPA 600/3-77-085, July 1977, p 88-117. 6 tab, 4 fig, 31 ref.

**Descriptors:** \*Bioassay, \*Toxicity, Mortality, Methodology, Ammonia, Freshwater fish, Hydrogen ion concentration, Laboratory tests, Fish physiology, Biochemistry, Rainbow trout, \*Sulfides, Permeability, \*Free cyanide, Sulfide forms, Fathead minnow.

The changes in tolerance limits for the fathead minnow to free cyanide and dissolved sulfide forms were studied as a function of pH because the toxicity of weak acids and bases is known to be pH dependent. Experimental results could largely be explained by one of the gill permeability theories. (See also W78-12376) (EIS-Katz) W78-12382

**THE ACUTE TOXICITY OF NITRITE TO FISHES,**  
Montana State Univ., Bozeman. Fisheries Bioassay Lab.

R. C. Russo, and R. V. Thurston.  
In: Recent Advances in Fish Toxicology, Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, July 1977, p 118-131. 3 tab, 2 fig, 24 ref.

**Descriptors:** \*Nitrite, \*Nitrate, \*Ammonia, Bioassay, Chloride, Hydrogen ion concentration, Mortality, Aquaculture, Rainbow trout, Freshwater fish, Water pollution effects, Juvenile fish.

Bioassays indicated exposure to nitrite causes an increase in methemoglobin concentration in free blood. Rainbow and cutthroat trout are much more susceptible to nitrite than fathead minnows or sculpins. Rainbow trout fry are less susceptible to nitrite than larger rainbow trout. The toxicity of nitrite is related to nitrite ion concentration not nitrous acid concentration and changes in pH in the range of 7.5-8.5 do not affect nitrite toxicity and an increase in chloride concentration causes a decrease in nitrite toxicity. (See also W78-12376) (EIS-Katz) W78-12383

**COPPER TOXICITY: A QUESTION OF FORM,**  
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.  
G. A. Chapman, and J. K. McCrady.

In: Recent Advances in Fish Toxicology, U.S. Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, July 1977, p 132-151. 1 tab, 11 fig, 14 ref.

**Descriptors:** \*Metals, \*Copper, Toxicity, Bioassay, Laboratory tests, Water pollution effects, Path of pollutants, Water quality, Chinook salmon, Alkalinity, Methodology, Daphnia, \*Cupric ion.

A series of bioassays were conducted to evaluate the toxicity of copper to fish with its chemical form. Even if acutely lethal copper ions can be determined on the basis of cupric ion activity, a similar relationship with chronic toxicity is not assured. Field studies, chronic toxicity studies, application factors or short-term indicator tests would still be required to estimate safe levels. The data relating copper toxicity to cupric ion activity are far from being definitive. (See also W78-12376) (EIS-Katz) W78-12384

**THE ROLE OF CYANIDE AS AN ECOLOGICAL STRESSING FACTOR TO FISH,**  
Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences.  
G. Leduc.

In: Recent Advances in Fish Toxicology, Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, July 1977, p 152-182. 17 fig, 34 ref.

**Descriptors:** Bioassay, Methodology, \*Water pollution effects, Mortality, Toxicity, Fish physiology, Biochemistry, \*Pathology, Laboratory tests, Laboratory equipment, Salinities, Industrial wastes, Path of pollutants, Stress, Environmental effects, Arsenic compounds, \*Water quality standards, \*Free cyanide, \*Maximum permissible level, Toxicology, Cyanides.

Cyanide, at concentrations as low as 0.01 mg l<sup>-1</sup> HCN, produces individual stresses on fish which, when integrated into a single total response, so seriously affect the energy supply processes, that both the range and scope for activity are reduced. The proposed toxicological model suggests that, at least under laboratory conditions, the fish could not continue to exist as populations. Not all physiological parameters were equally affected by cyanide but it appears that the greater energy-demanding processes, such as fat biosynthesis, osmoregulation and swimming were more seriously affected by this respiratory poison. These results were integrated into a single ecophysiological response-curve - a Relative Performance Index - which was used to develop a cyanide-stressed Scope for Activity model. This model suggests a 50% reduction in the overall performance of the fish at 0.01 mg l<sup>-1</sup> HCN and supports the previously established water quality criteria for cyanide, i.e., a maximum permissible level of 0.005 mg l<sup>-1</sup> HCN. (See also W78-12376) (EIS-Katz) W78-12385

**AN ASSESSMENT OF APPLICATION FACTORS IN AQUATIC TOXICOLOGY,**  
Environmental Research Lab.-Duluth, MN.  
D. I. Mount.

In: Recent Advances in Fish Toxicology, Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, July 1977, p 183-190. 1 tab, 10 ref.

**Descriptors:** \*Toxicity, \*Mortality, Bioassay, Methodology, \*Lethal limit, Water quality, Water pollution effects, Laboratory tests, Mathematical analysis, \*Water quality standards, Growth, Reproduction, \*Aquatic toxicology, Application factors, \*MATC, LC50.

In the early 1950's, application factors to estimate 'safe' concentrations from LC50's were proposed. Later, an experimental method of estimating the numerical value of the application factor was proposed to replace arbitrary values such as 1/10. Both measured values and arbitrary ones have been widely employed in water quality criteria by regulatory agencies. An examination of the data base for establishing application factors for various pollutants in different water types and for various species, reveals an unacceptable spread in their numerical value. Several factors such as chemical effects of the water on the pollutant, experimental error and biological variability must be contributing to this spread thereby making a determination of their real validity difficult. A better method to predict concentrations that will not affect survival, growth, and reproduction is needed for present toxicological requirements. (See also W78-12376) (EIS-Katz) W78-12386

**CLOSING REMARKS—AN OLD FROG CROAKS AN APPEAL FOR LOGIC,**  
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.  
For primary bibliographic entry see Field 5G. W78-12387

**TOXICITY STUDIES ON MARINE ANIMALS,**  
Cape Town Univ. (South Africa). Dept. of Zoology.  
A. C. Brown.  
South African Journal of Science, Vol. 72, No. 7, p 197-199, 1976. 14 ref.



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**Descriptors:** \*Toxicity, \*Marine pollution, Synergism, Animal survival, Susceptibility, Bioindicators, Bioassay, Laboratory studies, Pollution effects, Toxins, Trace elements, Metals, Animal behaviour, Temperature effect, Salinity, Environmental effects, Crustacea, Embryonic growth stage, Oil spills, Bivalves, Short term pollution effects, Arniston, Agulhas, South Africa, *Chloromytilus*, *Parechinus*, *Bullia*.

Incompetent research is lamented which has been done in the past in determining the thresholds of toxicity on various aquatic creatures for given pollutants, and no consideration had been given in this type of work to the fact that some stages in life history of an animal may be far more sensitive than others, or that sub-lethal concentrations may place the animal under stress, affect its metabolism, influence its reproductive ability, change its behaviour or reduce its life-span. It is suggested that our knowledge of toxicity will remain rudimentary until we are able to predict the effects of pollution, not only on individuals of a species but also on the community and the ecosystem as a whole. (So Afr Water Info Ctr)

W78-12424

#### SUSPECTED KILLER UNDER THE MICROSCOPE.

Council for Scientific and Industrial Research, Pretoria (South Africa).  
For primary bibliographic entry see Field 5A.

W78-12446

#### BLUE-GREEN ALGAE IN THE NORTHERN DONETS-DONETS BASIN CANAL (IN RUSSIAN).

Central Control Research Project, Donetsk (USSR). Research Water Lab.  
A. I. Kovrizhnykh.

Gidrobiol Zh 13(2), p 62-65, 1977.

**Descriptors:** \*Cyanophyta, \*Canals, Eutrophication, Algae, Donets-Donets Basin Canal(USSR), Water pollution, *Anabaena-Flos-Aquae*, *Anabaena-Varia*, *Aphanizomenon-Flos-Aquae*, Distribution, *Microcystis-Aeruginosa*.

Changes in the numbers and distribution of planktonic blue-green algae (*Aphanizomenon flos-aquae*, *Microcystis aeruginosa*, *Anabaena varia*, *A. flos-aquae*) were studied in the Northern Donets-Donets Basin Canal (USSR). Changes in the studied parameters were the result of an increase in the water released from krasnooskol Reservoir, the canals source of algae and changes in the hydrological conditions of the canal itself on the other. Copyright 1978, Biological Abstracts, Inc.

W78-12464

#### OCCURRENCE OF NANNOCYTES IN MICROCYSTIS.

J. A. Pretorius, and J. N. Eloff.  
South African Journal of Science, Johannesburg, Vol 73, No 8, p 245-246, 1977. 9 ref.

**Descriptors:** Pure cultures, Algae cultures, Reproduction, Propagation, \*Eutrophication, South Africa, \*Nannocytes, microcystic, \*Cyanophyceae.

Nannocytes are the small cells formed by *Chlorogloia microcystoides* and *Gleocapsa Crepidinum*. Nannocytes play a role in the propagation of *Microcystis* rather than in overwintering during wintering during unfavourable conditions. Nannocytes could play an important part in the sudden bloom formation typically associated with *Microcystis* in nature. Nannocytes were also observed in other isolates of *Microcystis* growing in the authors laboratory as well as in several naturally occurring blooms, suggesting that the formation of nannocytes by *Microcystis* is a widespread phenomenon. (So Afr Water Info Ctr)

W78-12474

#### WATER EUTROPHICATION - A 20TH CENTURY PROBLEM, PART 1.

Council for Scientific and Industrial Research (South Africa). National Inst. for Water Research. J. Hemens.

Chemsa, (Johannesburg), Vol 3, No 11, p 185, 186, 187, 1977, 2 ref, 1 tab, 1 fig.

**Descriptors:** \*Eutrophication, Ecology, Human activity, Deoxygenation, Algae, Effluent, Storm-water runoff, Detergents, Phosphorus, Biomass, Nitrogen fixation, Nutrient enrichment, South Africa.

Eutrophication caused by excessive enrichment of water with plant nutrients derived from areas of high population density and industrial development reduces the value of water resources in several ways. The causes and effects of eutrophication are described. (So Afr Water Info Ctr)

W78-12487

#### NITROGEN AND PHOSPHORUS INPUT TO THE MIDMAR DAM, NATAL.

Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research. J. Hemens, and D. E. Simpson.

Water South Africa, Vol. 3, No. 4, p 193-201, 1977.

**Descriptors:** \*Nitrogen, \*Phosphorus, \*Nutrient enrichment, Surface runoff, Surface loading, Algal growth, Available nutrients, Oligotrophic lakes, Mesotrophic lakes, Dry deposition, Catchment areas, Anthropogenic effects, Land use, Atmospheric precipitation, River flow, Growth limiting nutrients, \*Eutrophication, Midmar dam, South Africa, Umgeni catchment.

From March 1973 to February 1974 the mass of nutrients carried to the Midmar Dam by surface drainage was equivalent to a surface loading rate of 0.62 g total phosphorus and 8.49 g total soluble nitrogen m<sup>-2</sup>a<sup>-1</sup>. The mean annual rate of phosphorus is probably approximately half this value. Throughout the same period algal growth in the dam water was limited by the amount of phosphorus available, and the dam was in an oligotrophic-mesotrophic condition. Atmospheric nutrient deposition in the dam catchment was measured during 1975-76 and this source probably provides a small but significant contribution to the total annual input. The vegetation and soil of the catchment retains most of the nutrients reaching the land surface. In view of possible development in the catchment the increase in phosphorus loading rate that could be permitted without development of algae-associated problems is discussed. (So Afr Water Info Ctr)

W78-12491

#### CAMPS BAY BEACH. A POLLUTION SURVEY.

G. A. Eagle, and A. H. Fricke.  
South African Journal of Science, Johannesburg, Vol 73, No 11, p 342-345, 1977. 8 ref, 4 tab, 3 fig.

**Descriptors:** Pollution survey, Sewage disposal, Ocean outfall, Analysis results, Site investigations, Biological samples, Chemical analysis, Bacteriological examination, Camps Bay beach, South Africa.

Analytical results of water and sediment samples, collected from Camps Bay beach prior to the start of sewage disposal, reveal that the beach is well suited for recreational purposes. No fecal bacteria were found, nutrient and oxygen concentrations were well within the limits expected for clean beaches and meiofaunal populations were not limited by any chemical considerations. (So Afr Water Info Ctr)

W78-12507

#### MODEL EXPERIMENTS ON POLIOMYELITIS SURVEILLANCE IN AN URBAN POPULATION

#### OF THE RUHR VALLEY (ESSEN) BY INVESTIGATIONS OF THE SEWAGE WATER (IN GERMAN).

Essen Univ. (Gesamthochschule) West Germany). Abt. fuer Medizinische Virologie und Immunologie.

For primary bibliographic entry see Field 5A.

W78-12511

#### INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: BENZOTRIAZOLES.

Syracuse Research Corp., NY. Center for Chemical Hazard Assessment.

For primary bibliographic entry see Field 5B.

W78-12513

#### STUDIES OF PHYTOPLANKTON BIOGENIC ELEMENT REQUIREMENTS IN DIFFERENT TYPES OF LAKES USING A METHOD OF PLANNED SUPPLEMENTS (IN RUSSIAN).

Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.

N. A. Petrova, G. F. Raspletina, and B. L. Gusakov.

Bot Zh (Leningr) 62(7), p 984-989, 1977.

**Descriptors:** *Ankistrodesmus-pseudomirabilis*, *Asterionella-formosa*, *Didymocystis-plac-tonica*, *Dinobryon-cylindricum-var-palustre*, *Dinobryon-cylindricum-var-palustre*, *Dinobryon-sociale-var-stipitatum*, *Lingbya-contorta*, *Melosira-ambigua*, *Melosira-distans-var-alpigena*, *Melosira-granulata*, *Melosira-islandica-spp-helvetica*, *Oscillatoria-subtilissima*, *Scenedesmus-bijugatus*, *Thalassionema*, \*USSR, Eutrophication, \*Oligotrophy, \*Mesotrophy, Lakes.

Mineral element requirements of phytoplankton (*Melosira islandica ssp. helvetica*, *M. distans* var. *alpigena*, *Asterionella formosa*, *M. ambigua*, *M. granulata*, *Oscillatoria subtilissima*, *Lingbya contorta*, *Scenedesmus bijugatus*, *Ankistrodesmus pseudomirabilis* var. *spiralis*, *Didymocystis plac-tonica*, *Dinobryon cylindricum* var. *palustre*, *D. sociale* var. *stipitatum*, and *Thalassionema*) in oligotrophic (Lake Onega) and mesotrophic (Lake Lacha and Vozhe) lakes in the USSR according to seasonal development were analyzed and compared. The method involved a complete factorial experiment which permitted a statistical analysis and qualitative evaluation of phytoplankton requirements. Biogenic elements were introduced in the form of readily soluble salts (NaH<sub>2</sub>PO<sub>4</sub>, NH<sub>4</sub>Cl, NaNO<sub>3</sub>, and FeSO<sub>4</sub>). Determining limiting factors of development and phytoplankton productivity at different levels of mineral nutrition permitted assumptions on ecological specificities to be made. Copyright 1978, Biological Abstracts, Inc.

W78-12514

#### EXCRETION OF MERCURY FROM FISH (IN JAPANESE).

Tokyo Univ. of Fisheries, (Japan).

For primary bibliographic entry see Field 5B.

W78-12515

#### METAL SURVEY OF THE MARINE CLAM PITAR MORRHUANA COLLECTED NEAR A RHODE ISLAND (USA) ELECTROPLATING PLANT.

Environmental Research Lab., Narragansett, RI. For primary bibliographic entry see Field 5B.

W78-12516

#### EXPERIMENTAL STUDIES ON THE RELATIONSHIP BETWEEN NATURAL COPPER COMPLEXES AND THEIR TOXICITY TO PHYTOPLANKTON.

Laboratoire de Physique et Chimie Marines, Vilefrance-sur Mer (France). Station Marine. M. Gnassia-Barelli, M. Romeo, F. Laumond, and D. Pesando.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Effects Of Pollution—Group 5C

Marine Biology, Vol 47, p 15-19, 1978. 2 fig, 2 tab, 22 ref.

Descriptors: \*Copper, Plant physiology, \*Phytoplankton, \*Toxicity, \*Organic compounds, Metabolism, Metals, Chelation, Chemical analysis, Primary productivity, Path of pollutants, Cytological studies, Bioavailability.

Toxicity of copper to phytoplankton depends on the physicochemical form of the metal. Organic substances liberated into the culture medium by the phytoplankton species *Cricophanes elongata* are able to detoxify and complex copper. The molecular weight range of these organic substances has been determined by ultrafiltration. (EIS-Deal) W78-12518

**ECOLOGICAL EFFECTS OF MARINE OIL POLLUTION.**  
Field Studies Council, Pembroke (England). Oil Pollution Research Unit.  
J. Baker, J. Addy, B. Dicks, S. Hainsworth, and D. Levell.  
Rapports et Proces-verbaux des Reunions, Conseil International Pour L'Exploration de la Mer, Vol 171, p 196-201, 1977. 18 ref.

Descriptors: \*Intertidal areas, \*Oil spills, \*Oil wastes, \*Dispersion, \*Toxicity, \*Water pollution effects, \*Salt marshes, On-site investigations, Methodology, Biological communities, Oil pollution, Environmental effects, Laboratory tests, Oil industry, Invertebrates, Mollusks, Coastal marshes, \*Sub-lethal effects, Arenicola, Littorina.

Field surveys in the intertidal zone provided information on the effects of oil spills, cleaning treatments and refinery effluents. More precise results for rocky shores, saltmarshes and lugworm beds were obtained by field experiments. The survey and experimental methods are briefly described, and results for the different biological communities summarized. Effects of oils and effluents vary considerably according to type and quantity of oil, cleaning treatment (if any), effluent characteristics, and hydrography and biology of the area affected. Related laboratory work concerns the toxicity ranking of oils, dispersants, effluents and effluent constituents; and behavioral responses of some organisms to sub-lethal doses of pollutants. Offshore surveys in Milford Haven, and the Celtic and North Seas, were initiated and are briefly referred to. (EIS-Katz) W78-12519

**CHEMICAL CHARACTERISTICS OF LAKE MARYUT, A POLLUTED LAKE SOUTH OF ALEXANDRIA, EGYPT.**  
Alexandria Inst. of Oceanography and Fisheries (Egypt).  
For primary bibliographic entry see Field 5A. W78-12520

**EXCRETION RATE OF 65ZN; IS IT A USEFUL TOOL FOR ESTIMATING METABOLISM OF FISH IN THE FIELD.**  
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.  
D. E. Hoss, D. S. Peters, W. F. Hettler, and L. C. Clements.  
Journal of Experimental Marine Biology and Ecology, Vol 31, p 241-252, 1978. 2 fig, 7 tab, 23 ref.

Descriptors: \*Fish physiology, \*Animal metabolism, \*Zinc, \*Metabolism, Biochemistry, Sea basses, Oxygen demand, Food habits, Feeding rates, Size, Respiration, Methodology, Laboratory tests, \*Pinfish, Bioaccumulation.

Several experiments were conducted with pinfish and black sea bass to determine the practicality of using the rate of loss of <sup>65</sup>Zn to estimate the

metabolic rate of fish under natural conditions. No significant correlations were found between this and oxygen consumption, feeding rate, fish size, or temperature. Restricting fish movement had no consistent effect on zinc loss nor did elevated levels of inorganic zinc in the diet. Because of the lack of positive results, it was concluded that the rate of loss of <sup>65</sup>Zn is not a practical method for estimating field metabolism of fish. (EIS-Deal) W78-12521

**THE EFFECT OF SEWAGE EFFLUENT ON GRASMERE (ENGLISH LAKE DISTRICT) WITH PARTICULAR REFERENCE TO INORGANIC NITROGEN TRANSFORMATIONS.**  
Freshwater Biological Association, Windermere (England).  
G. H. Hall.  
Freshwater Biology, Vol 8, p 165-175, 1978. 5 fig, 5 tab, 41 ref.

Descriptors: \*Sewage effluent, \*Hypolimnion, \*Eutrophication, \*Nitrogen cycle, \*Nitrogen compounds, Waste water treatment, Sewage treatment, Bacteria, Oxygen demand, Nitrification, Phosphorous, Nutrients, Ammonia, Denitrification, Chemical reactions, Water pollution sources, Environmental effects, Lakes, \*Grasmere, English Lake District.

In the summer of 1971, the village of Grasmere was converted from septic tank to mains drainage with sewage treatment at an activated sludge plant. The effluent was discharged into the River Rothay, the main inflow of a nearby small lake (Grasmere). This paper describes some of the effects on the lake. The mean areal hypolimnetic oxygen deficit increased with an accompanying marked increase in the degree of deoxygenation in the hypolimnion. Plate counts of bacteria in the surface water increased for 2 years but this increase was not sustained. The mean summer soluble reactive phosphorous concentration did, however, increase significantly, but the same was not true of nitrate levels. Analyses of the main inflow have shown that 50-98% of the ammonia and 10-40% of the nitrate entering in this river was derived from the sewage effluent. The concentrations in the main body of the lake were usually lower, possibly due to assimilation and denitrification in the shallower reaches of the lake. Seasonal changes in the inorganic nitrogen species in the hypolimnion showed three distinct phases of activity, ammonification, nitrification, and denitrification. Nitrification accounted for approximately a quarter of the oxygen uptake in the hypolimnion. (EIS-Deal) W78-12522

**OCCURRENCE AND FATE OF ORGANIC AND INORGANIC CONTAMINANTS IN MARINE ANIMALS.**  
Torry Research Station, Aberdeen (Scotland).  
For primary bibliographic entry see Field 5B. W78-12523

**ASSESSMENT TECHNIQUES FOR MODELLING WATER QUALITY IN A RIVER BASIN IMPACTED BY COAL RESOURCE DEVELOPMENT.**  
Geological Survey, Denver, CO.  
For primary bibliographic entry see Field 5B. W78-12542

**COMPARATIVE BACTERIOLOGICAL STUDY OF LETTUCE (LACTUCA SATIVA) FROM THE SANTIAGO AREA AND COASTAL REGIONS (IN SPANISH).**  
Instituto Bacteriologico de Chile, Santiago.  
R. Lobos, J. Garcis-M, and C. Aguilar-A.  
Bol Inst Bacteriol Chile 18(1/2), p 33-37, 1976.

Descriptors: Bacteriology, \*Lettuce, Coasts, \*Bacteria, Irrigation water, Water pollution

sources, \*Chile, \*Coliforms, \*E. Coli, Ponds, \*Salmonella, Sedimentation, \*Shigella.

The existence of enteropathogenic bacteria (Salmonella, Shigella and Escherichia coli) and coliforms in lettuce from Santiago and coastal areas of Chile was studied. The percentages of contamination by enteropathogenic bacteria were 18.5 and 3.4 for Santiago and the coastal areas, respectively. The origin of these enteropathogens and coliforms was probably the contaminated water used for irrigation. The use of sedimentation ponds for the treatment of irrigation water was suggested. Copyright 1978, Biological Abstracts, Inc. W78-12554

**MICROBIOLOGICAL CONDITIONS OF THE WATERS AROUND THE AUGUSTA ROAD-STEAD (IN ITALIAN).**  
Messina (Italy). Ist. di Idrobiologia.  
S. Genovese, and M. De Donato.  
Atti Soc Peloritana Sci Fis Mat Nat 21, p 157-168, 1975.

Descriptors: \*Microbiology, Surveys, Industrial wastes, \*Pollutant identification, Water pollution effects, \*Bacteria, \*Coliforms, \*Eutrophication, Italy, Microorganisms.

Two surveys were made during Dec. 1970 and Jan. 1971 on Ionian waters beyond the Augusta Roadstead, Italy. Eutrophication level of this area which borders a highly industrialized area was measured. The role played by mineralizing microorganisms, mainly coliform bacteria, was analyzed. Copyright 1978, Biological Abstracts, Inc. W78-12556

**SOME REGULARITIES IN THE CHANGES IN LAKE ECOSYSTEMS IN CONNECTION WITH ANTHROPOGENIC FACTORS (IN RUSSIAN).**  
Polish Academy of Sciences, Warsaw. Inst. of Ecology.  
For primary bibliographic entry see Field 2H. W78-12557

**SEASONAL VARIABILITY IN THE BIOCHEMICAL COMPOSITION OF PLANKTON IN THE MINGECHAUR AND VARVARA RESERVOIRS (IN RUSSIAN).**  
Akademiya Nauk Azerbaidzhanskoi SSR, Baku. Inst. Zoologii.  
For primary bibliographic entry see Field 2H. W78-12560

**ENERGETICS OF A SALMON LAKE ECOSYSTEM (IN RUSSIAN).**  
Akademiya Nauk SSR, Moscow. Inst. Biologii Vnutrennykh Vod.  
Y. I. Sorokin, and E. B. Pavel'eva.  
Zh Obshch Biol 38(4), p 512-527, 1977.

Descriptors: Autotrophy, Heterotrophy, \*Primary production, Lakes, Ecosystems, \*Lake Dalnee (Russian SFSR), USSR, \*Plankton, Detritus.

Energy flow diagrams of the pelagic ecosystems of Lake Dalnee (the Kamchatka peninsula (Russian SFSR, USSR) were made during warm (1970) and cold (1971) seasons. In 1971 the food chain was shorter and, consequently, the efficiency of utilization of the primary production was higher than in 1970; 16-70% of the primary energy input was used in the ecosystem in the form of detritus. Seasonal succession in the planktonic community passes through autotrophic and heterotrophic phases. Copyright 1978, Biological Abstracts, Inc. W78-12614

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**SPECIES COMPOSITION OF PHYTOPLANKTON FROM DIFFERENT TYPES OF LAKES IN THE CENTRAL KARELIAN ISTHMUS (IN RUSSIAN),** Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.  
I. S. Trifonova, and V. I. Martynova.  
Bot Zh (Leningr) 62(7), p 990-998, 1977.

**Descriptors:** Ecology, \*Productivity, \*Phytoplankton, Lakes, Russian SFSR, USSR, Cyanophyta, Chrysophyta, Bacillariophyta, Pyrrophyta, Euglenophyta, Xanthophyta, Chlorophyta.

Data on species composition, ecology and maximum numbers of phytoplankton from 4 lakes (Krasnoe, Pravdinskoe, Vishnevskoe, and Michurinskoe) of the Karelian Isthmus (Russian, SFSR, USSR) are presented. The lakes were compared according to area, depth, transparency, pH,  $\text{N-NO}_3$ ,  $\text{P-PO}_4$ ,  $\text{Si-SiO}_2$ , and Fe content, biological productivity and phytoplankton composition. Phytoplankton composition consisted of 7 groups (Cyanophyta, Chrysophyta, Bacillariophyta, Pyrrophyta, Euglenophyta, Xanthophyta, and Chlorophyta) are included 133 spp.—Copyright 1978, Biological Abstracts, Inc.  
W78-12620

**ATMOSPHERIC NITROGEN AND PHOSPHORUS LOADING TO HARP LAKE, ONTARIO, CANADA,** Ontario Ministry of the Environment, Rexdale (Ontario). Water Resources Branch.  
For primary bibliographic entry see Field 5B.  
W78-12626

**CURRENT CONDITIONS AND INTENSITY OF SELF-PURIFICATION IN THE UPPER REACHES OF THE SUKHONA RIVER (IN RUSSIAN),** Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.  
D. N. Aleksandrova, T. D. Slepukhina, N. Yu. Senatskaya, A. V. Kuleshev, and L. F. Zhekhnovskaya.  
Gidrobiol Zh 13(2), p 86-91, 1977.

**Descriptors:** Bacteria, Benthos, Biochemical oxygen demand, Oligochaetes, Pollution, USSR, Sukhona River (USSR), Self-purification, Lake Kubenskoye (USSR), Bioindicators.

A 42-km segment of the Sukhona River was studied in conjunction with the projected diversion of its waters and their consequent effect of Lake Kubenskoye, USSR. Twenty-six hydrological, hydrochemical and biological indices were analyzed. Intensity of biological processes and changes in indices along the course of the river were determined. The extent of pollution and self-purification of the water and bottom sediments were evaluated on the basis of total quantity of oligochaetes, index of macrobenthos species variety, bacteria/saprophyte ratio and biochemical oxygen demand. The wastes of cellulose-paper industry located on the river present a particularly significant threat to water quality in Lake Kubenskoye.—Copyright 1978, Biological Abstracts, Inc.  
W78-12654

**EFFECT OF ADDITIONS OF FERTILIZER AND VEGETATION ON GROWTH OF MAJOR INDIAN CARPS IN PONDS CONTAINING GRASS CARP,** Central Inland Fisheries Research Inst., Cuttack (India). Fisheries Research Station.  
P. R. Sen, N. G. S. Rao, R. D. Chakrabarty, S. L. Kar, and S. Jena.  
The Progressive Fish Culturist, Vol. 40, No. 2, p 69-70, 1978, 3 tab, 3 ref.

**Descriptors:** Freshwater fish, \*Nutrients, \*Aquaculture, Fertility, \*Fertilizers, Fish

establishment, Fish harvest, Commercial fishing, \*Waste treatment, Animal growth, Survival, Animal wastes (Wildlife), Carp, Polyculture ponds, Fish excreta, Grass carp, Ctenopharyngodon idella, Indian carp, Catla, Rohu, Labeo, Mrigal, Cirrhinus, Manure.

Observations of fish growth in polyculture ponds suggest that fertilization of pond water by the excreta of grass carp (Ctenopharyngodon idella) may enhance the growth of the indigenous Indian carps catla (Catla catla) rohu (Labeo rohita) and mrigal (Cirrhinus mrigala) to about the same extent as fertilization by the addition of manure. (EIS-Katz)  
W78-12669

**SEASONAL ASPECTS OF OVERGROWTH OF BIOCEANOSES, (IN RUSSIAN),** Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.  
I. A. Skalskaya.  
Gidrobiol Zh 12(4), p 49-54, 1976.

**Descriptors:** \*Biocenoses, Caddis-fly, Diversity, Electric power plants, Invertebrates, Larvae, Mussels, Overgrowth, \*Seasonal, Temperature, Thermal pollution, Water pollution effects.

The seasonal changes in biocenoses of artificial woody substrate overgrowths were considered in the Gorky reservoir (USSR) within the warm water zone near the Kostroma State electric station and beyond. In the hottest period (July-Aug.) in the warm zone the hydrobionts endured a negative effect of high temperature near the station and in the bay where warm water is delivered. Here the substrate was populated weakly by zebra mussel, caddisfly larvae and other organisms. In autumn, the substrate is more highly populated by hydrobionts and the fauna is more diverse than it is beyond the limits of the station's warming effects.—Copyright 1977, Biological Abstracts, Inc.  
W78-12670

**HISTORICAL AND CURRENT HEAVY METAL RESIDUES IN HUDSON RIVER FISH,** Marist Coll., Poughkeepsie, NY. Research Inst.  
For primary bibliographic entry see Field 5B.  
W78-12671

**TRACE METALS IN SEA SCALLOPS, PLACOPECTEN MAGELLANICUS, FROM EASTERN UNITED STATES,** National Marine Fisheries Service, Milford, CT. Milford Lab.  
For primary bibliographic entry see Field 5A.  
W78-12672

**MICROBIAL ECOLOGY STUDIES OF METULA SPILL IN THE STRAITS OF MAGELLAN,** Maryland Univ., College Park. Dept. of Microbiology.  
R. R. Colwell, A. L. Miller, J. D. Walker, P. Garcia-Tello, and V. Campos-P.  
Journal of the Fisheries Research Board of Canada, Vol. 35, p 573-580, 1978, 4 fig, 11 tab, 11 ref.

**Descriptors:** \*Oil, \*Oil spills, \*Microbial degradation, \*Bacteria, \*Biological communities, \*Beaches, \*Ecology, Oil pollution, Organic compounds, Water pollution effects, Biodegradation, Population, Sediments, Littoral, Chromatography, Microorganisms, \*Oil tankers, \*Crude oil, Metulla oil spill.

The grounding of the tanker V.L.C.C. Metula in the Straits of Magellan in August of 1974 provided a unique opportunity to study a massive spill in a cold region on a long-term basis. Removal of spilled oil was solely by in situ physicochemical and biological mechanisms. Microbiological studies undertaken in May 1976 showed increased

heterotrophic bacterial populations at oil-impacted sites. A cold-tolerant population of petroleum degrading bacteria was observed. From biodegradation studies, we concluded that oil degradation under in situ conditions proceeds relatively slowly, with marked persistence of oil in the Straits of Magellan 2 yr after the original spill (EIS-Deal)  
W78-12673

**BIOAVAILABILITY OF CRUDE OIL FROM EXPERIMENTALLY OILED SEDIMENTS TO ENGLISH SOLE (PAROPHYRUS VETULUS), AND PATHOLOGICAL CONSEQUENCES,** National Marine Fisheries Service, Seattle, WA. Environmental Conservation Div.  
For primary bibliographic entry see Field 5B.  
W78-12674

**PATHOLOGICAL CHANGES IN A MARINE FISH AFTER A 6-MONTH EXPOSURE TO PETROLEUM,** Fisheries and Marine Service, St. John's (Newfoundland). Biological Station.  
J. F. Payne, J. W. Kicenink, W. R. Squires, and G. L. Fletcher.  
Journal of the Fisheries Research Board of Canada, Vol. 35, p 665-667, 1978, 1 tab, 13 ref.

**Descriptors:** \*Oil, \*Oil pollution, \*Oil spills, \*Cytological studies, \*Animal pathology, \*Poisons, \*Fish physiology, \*Animal metabolism, \*Toxicity, \*Mortality, \*Marine fish, Organic compounds, Ecosystems, Path of pollutants, Water pollution effects, \*Crude oil, \*Tissue analysis, \*Cunner, \*Tautogolabrus.

Cunners (Tautogolabrus adspersus) were chronically exposed to Venezuelan crude in a flow-through seawater system. The survival rate was greater than 95%. The following parameters were examined: appearance of fish and internal organs from a series of color photographs; fish condition index; hematocrit; somatic indices of liver, heart, spleen, and gonads; eye lens diameter; and plasma chloride. Liver, kidney, heart, spleen, gonad, gill, muscle, and gut tissues were also examined from paraffin sections for pathological changes. There were significant differences in testis somatic index, lens diameter, and plasma chloride between the two fish groups. No histopathological changes were observed. (EIS-Deal)  
W78-12675

**PETROLEUM TAINING IN FISH,** Torry Research Station, Aberdeen (Scotland).  
P. Howgate, P. R. Mackie, K. J. Whittle, J. Farmer, and A. D. McIntyre.  
Rapports et Proces-Verbaux de Reunions, Conseil International Pour L'Exploration de la Mer, Vol. 171, p 143-146, 1977, 2 tab, 12 ref.

**Descriptors:** \*Organoleptic properties, \*Taste, \*Commercial fish, \*Benthic fauna, \*Oil, \*Water pollution effects, \*Shrimps, \*Lobsters, \*Odor, \*Pollutant identification, Fish diets, Chemical properties, Laboratory test, Commercial shellfish, Invertebrates, Marine fish, Bottom sediments, \*Tainting, \*North Sea crude oil, Pleuronectes, Nephrops, Crangon, Plaiice.

'Petroleum' taints in fish flesh do not necessarily arise by petroleum contamination. Such taints are well known in certain fisheries and have been traced to natural dietary components. Tainting of the flesh which is due to petroleum contamination however is usually accompanied by the presence in the flesh of hydrocarbons derived from the contaminating source, but these hydrocarbons are not necessarily responsible for the taint. Experimental tainting studies in benthic organisms by using sediment contaminated with a North Sea crude oil are described. (EIS-Deal)  
W78-12676



**DISTRIBUTION AND TOXICITY OF SELECTED WATER POLLUTANTS IN THE SPINY DOGFISH, SQUALUS ACANTHIAS**, National Cancer Inst., Bethesda, MD. A. M. Guarino, G. Rieck, S. Arnold, P. Fenstermacher, and J. Bend. The Bulletin, Mount Desert Island Biological Laboratory, Salsbury Cove, Maine, Vol. 16, p 50-53, 1976. 2 tabs.

Descriptors: \*Oil, \*Oil spills, Fish physiology, Animal pathology, Biochemistry, Toxicity, Water pollution effects, \*Phenols, Detergents, Surfactants, Methodology, Bioassays, Radioactive isotopes, Radioactivity, Spiny dogfish, Squalus acanthias, Octane, Sodium lauryl sulfate, Tissue concentrations.

A study was made of the pharmacologic disposition of two known components of crude oil, octane and phenol, as well as a detergent, sodium lauryl sulfate. The test organism used was the spiny dogfish. Phenol was localized in the liver and muscle. Phenol is rapidly cleared by gill mechanisms. Fish have more ways of protecting themselves from the acute toxicity of xenobiotics than do most terrestrial animals. (EIS-Katz) W78-12677

**GROWTH AND CELL CONSTITUENTS OF SEVERAL YEASTS ON THE PULP MILL WASTE LIQUOR (IN KOREAN)**, Seoul National Univ. (Republic of Korea). Dept. of Botany. Dong Ky. Ju. Korean J Microbiol 14(1), p 1-7, 1976.

Descriptors: Carbohydrates, Cryptococcus-luteolus, Debaryomyces-castelli, Debaryomyces-phaffii, Fodder, Lipids, Proteins, \*Cytological studies, \*Yeasts, Nutrients, \*Growth rates.

Effects of some nutrients on the growth of 3 yeast strains in the pulp mill waste liquor was determined during an attempt to lower the BOD (biochemical O<sub>2</sub> demand) content of the waste liquor and to produce fodder yeast. The strains used were Debaryomyces castelli Capriotti, D. phaffii Capriotti and Cryptococcus luteolus (Saito) Skinner. The necessity of the addition of 0.2% (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, 0.5% yeast extract, 0.2% KH<sub>2</sub>PO<sub>4</sub> and 0.1% MgSO<sub>4</sub>·7H<sub>2</sub>O for the best growth of all 3 strains in waste liquor was ascertained. After a 3 day growth of yeast cells on the waste liquor, the BOD content was lowered by about 60-70%. Harvested yeast cells contained about 75% water with 1.5-3% lipid, 40-46% protein, 50% carbohydrate and 3-5% ash on the dry weight basis, indicating the possibility of being utilized as the fodder yeast. Copyright 1978, Biological Abstracts, Inc. W78-12680

**AN EPIDEMIOLOGICAL SURVEY ON THE CLONORCHIASIS IN THE HAN RIVER SIDES (IN KOREA)**, Hanyang Univ., Seoul (Republic of Korea). School of Medicine. Y. S. Yun, and B. P. Chang. Korean Cent J Med 29(4), p 361-369, 1975.

Descriptors: Acanthorhodus-asmussii, Clonorchiasis, \*Clonorchis-sinensis, \*Epidemiology, Fishes, \*Han River, Hemibarbus-labeo, Hemibarbus-longirostris, \*Human diseases, \*Korea, Opsariichthys-bidens, Parafossarulus-manichouricus, Pseudogobio-esocinus, Pseudogobio-esocinus, Rivers, South, Zacco-platyptus, Carp.

The prevalence of Clonorchis sinensis in Han River (South Korea) banks was studied. Intradermal tests for clonorchiasis were performed for 664 inhabitants of river bank villages. Microscopic examination for metacercariae were conducted in 1399 fresh water fish of 19 spp. obtained from north and south Han River during the period

July 1974-Aug. 1975. Incidence rates of clonorchiasis in various villages on the right and left banks are presented. Clonorchiasis was higher in male inhabitants than in females. In the 20-60 yr age group, 88-98% male and 31-57% females admitted eating raw fresh water fish. The snail (Parafossarulus manichouricus) was present in all the areas surveyed, in various types of water bodies such as ditches, streams and reservoirs in the low flat area. Of 19 spp. of fresh water fish examined, 9 contained metacercariae of C. sinensis, (Hemibarbus longirostris, Opsariichthys bidens, Pseudogobio esocinus, Carassius carassius, H. labeo, cyprinus carpio, Pseudorasbora parva, Zacco platypus, and Acanthorhodus asmussii). Copyright 1977, Biological Abstracts, Inc. W78-12682

**DISSOLVED NUTRIENTS IN A PEATLAND NEAR HOUGHTON LAKE, MICHIGAN**, Utah State Univ., Logan. Dept. of Wildlife Science. J. A. Kadlec.

In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium Held at the Univ., of MI., Ann Arbor, May 10-11, 1976, p 25-50. 1976. 4 fig, 5 tab, 12 ref.

Descriptors: \*Nutrients, \*Wetlands, \*Peatland, Phosphorus, Nitrogen, Microbial degradation, Peat, Litter, \*Michigan, \*Houghton Lake(Mich).

General levels of most of the mineral nutrients in the Porter Ranch peatland are not particularly low in comparison with other surface waters and peat interstitial waters. A high degree of annual and spatial variability exists. Surface waters tended to be reasonably uniform in May and late fall when water levels are high. In late August, surface waters were very different among years and areas, especially in forms of nitrogen. Presumably at low water levels, local influences are dominant. Dissolved nutrients were sprayed on study plots. Nutrient additions had a very small impact on the peatland. Large amounts of nitrogen and phosphorous were tied up in surficial, mostly dead, organic materials. Apparently, very little penetrated to the roots of the vascular plants. Horizontal spreading also diluted the applications. (See also W78-12707) (Stihler-Mass) W78-12709

**PRODUCTIVITY AND NUTRIENT CONTENT OF EMERGENT MACROPHYTES IN TWO WISCONSIN MARSHES**, Wisconsin Univ.-Milwaukee. Dept. of Botany. D. Lindsley, T. Schuck, and F. Stearns. In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium Held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 51-75, 1976. 4 fig, 1 tab, 15 ref.

Descriptors: \*Nutrients, \*Primary productivity, \*Freshwater marshes, \*Wisconsin, Wetlands, \*Marshes, Rooted aquatic plants, Cattails, Wild rice, Soils, Sands, Phosphorus.

McNaughton Marsh, an infertile marsh in north-central Wisconsin, was studied and compared to the previously studied Theresa Marsh, a marsh in southeastern Wisconsin characterized by high nutrient values. Production in McNaughton Marsh varied greatly with species composition and density. Total net annual production probably ranges between 4 and 12 Tm/ha, considerably less than that estimated for Theresa Marsh. In general, nutrient concentrations in the above ground tissue tended to drop during the season. In contrast, roots accumulated nutrients as the top growth declined. Although species differed, the range of mineral nutrient levels in McNaughton Marsh plants were unexpectedly similar to levels in plants of Theresa Marsh. Apparently, soil nutrient concentrations are not low enough to limit growth at McNaughton Marsh. Presumably, the short growing season has the greater effect in reducing max-

imum biomass. Greenhouse studies using P32 indicate that nutrients in sand are more rapidly available than those in muck substrates. (See also W78-12707) (Stihler-Mass) W78-12710

**PLANT GROWTH, NUTRIENT ACCUMULATION AND DECOMPOSITION IN A CENTRAL MICHIGAN PEATLAND USED FOR EFFLUENT TREATMENT**, Michigan Univ., Ann Arbor. School of Natural Resources.

C. J. Richardson, W. A. Wentz, J. P. M. Chamie, J. A. Kadlec, and D. C. Tilton. In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 77-117, 1976. 12 fig, 6 tab, 53 ref.

Descriptors: \*Waste water treatment, \*Sewage effluents, \*Biological treatment, \*Wetlands, Peat, Litter, Soils, Nitrogen, Phosphorus, Nutrient removal, Nutrients, Michigan, Rooted aquatic plants, Productivity, Biomass.

Various levels of simulated sewage treatment effluent were applied to a peatland with vegetation typical of northern peat wetlands. No significant differences in nitrogen (N) and phosphorus (P) concentrations due to treatment levels 1X and 2X (X = concentrations of nutrients from domestic sewage effluent) were found in the vegetation analyzed. This is probably due to the unavailability of nutrients resulting from absorption and adsorption by the litter. Sedges in the 4X and 10X treatment plots showed a higher aboveground biomass along with higher N and P concentrations than controls. Grasses and asters showed decreased growth. The slow rate of subsurface movement (approx. 30 cm/day), high denitrification rates for waterlogged soils, high nutrient sorption capacity of organic litter and peat soils and nutrient uptake by some plant species all indicate that a peatland ecosystem has potential as a biological filter for treatment plant effluent. (See also W78-12707) (Stihler-Mass) W78-12711

**EFFECTS OF SEWAGE EFFLUENT ON ECOSYSTEM DYNAMICS IN CYPRESS DOMES**, Florida Univ., Gainesville. Center for Wetlands. K. C. Ewel.

In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 169-195, 1976. 10 fig, 5 tab.

Descriptors: \*Sewage effluents, \*Swamps, \*Florida, \*Biological treatment, Wetlands, Sediments, Floating plants, Trees, Plant growth, Litter, Water quality, Pathogenic bacteria, Viruses.

After 2-1/2 years of discharging secondarily treated sewage into cypress domes in north-central Florida, results are beginning to show that these swamp ecosystems may be capable of taking up nutrients at a rapid rate. Duckweed settles to the bottom, and anaerobic decomposition processes seem to break down the organic matter at a rapid enough rate to prevent filling of the dome with sediments. Groundwater quality is slightly altered, but pathogens seem to have been effectively removed by the ecosystem. Long-term observations are necessary in order to ensure that this system does indeed work. (See also W78-12707) (Stihler-Mass) W78-12714

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**PHOSPHORUS SOURCE MANAGEMENT FOR EUTROPHIC LAKES. PHASE I: TRIBUTARY PHOSPHORUS LOADING.**  
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology; and Rutgers - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.  
For primary bibliographic entry see Field 5B. W78-12746

**EFFECTS OF INJECTED ORGANOCHLORINES ON NATURALLY INCUBATED HERRING GULL EGGS.**  
Canadian Wildlife Service, Ottawa (Ontario). A. P. Gilman, D. J. Hallett, G. A. Fox, L. J. Allan, and W. J. Learning.  
Journal of Wildlife Management, Vol. 42, No. 3, p 484-493, 1978. 1 fig, 4 tab, 33 ref.

Descriptors: \*Chlorinated Hydrocarbon Pesticides, \*Gulls, \*Reproduction, Non-game birds, Water birds, Water pollution effects, Environmental effects, Polychlorinated biphenyls, DDE, Embryonic growth stage, Mortality, Toxicity, Absorption, Animal populations, Organic compounds, Pesticide toxicity, Pesticide residues, \*Photomirex, \*Mirex, Hexachlorobenzene, \*Tissue analysis.

Organochlorine contaminants were extracted from Lake Ontario herring gull (*Larus argentatus*) eggs and injected into relatively uncontaminated, uninjected gull eggs on Kent Island, New Brunswick. Synthetic mixtures of PCB's, DDE, mirex, photomirex, and hexachlorobenzene were injected in a similar fashion. All eggs were incubated by their natural parents. No increases in embryonic or chick mortality were observed in any contaminant injected group when compared to the injected controls. The embryonic uptake of pollutants was similar in naturally contaminated eggs and injected eggs. The significance of these findings with regard to the reproductive failure of Lake Ontario herring gulls is discussed. (EIS-Deal)  
W78-12750

**THE FREQUENCY, DISTRIBUTION, AND PATHOLOGY OF THREE DISEASES OF DEMERSAL FISHES IN THE BERING SEA.**  
National Marine Fisheries Service, Seattle, WA. Northwest Fisheries Center.  
B. B. McCain, M. S. Myers, W. D. Gronlund, S. R. Wellings, and C. E. Alpers.  
Journal of Fish Biology, Vol. 12, p. 267-276, 1978. 6 fig, 25 ref.

Descriptors: \*Fish diseases, \*Pathology, \*Commercial fish, Pacific Ocean, Marine fish, Marine fisheries, Alaska, Water pollution effects, Public health, \*Commercial fisheries, Bering Sea, Yellowfin, Rock Sole, Pacific cod, \*Disease frequency, \*Disease distribution.

During September and October, 1975, bottom-dwelling fish from the Bering Sea were examined for diseases. The three most commonly observed diseases and their frequency of occurrence were epidermal papillomas of rock sole, 1.0%; lymphocytis of yellowfin sole, 2.1%; and epidermal tumors of the pseudobranch of adult Pacific cod, 7.4%. Both the appearance and the histological characteristics of epidermal papillomas on rock sole resembled those found on several species of flatfish in Puget Sound. The frequency of tumor-bearing rock sole ranged from 1-23% with the highest occurrence at sampling stations around the periphery of the Bering Sea in water depths of 20-30 fathoms. The frequency of lymphocytis was 1-15%, with a gradual increase of prevalence from the northern to the southern sampling stations. Tumor-bearing cod were most commonly found in the south and south-eastern Bering Sea and the frequency of affected cod ranged from 0-100%. (EIS-Katz)  
W78-12751

**EFFECTS OF MICROBIAL ACTIVITY ON AQUATIC POLLUTANTS.**  
Maryland Univ., College Park. Dept. of Microbiology.  
M. J. Voll, J. Isbister, L. Isak, M. McCommas, and R. R. Colwell.  
Annals of the New York Academy of Sciences, Vol. 298, p 104-110, 1977. 1 fig, 3 tab, 20 ref.

Descriptors: \*Biodegradation, Microorganisms, \*Bacteria, \*Fungi, \*Oil pollution, \*Microbial degradation, Chesapeake Bay, Mercury, Polychlorinated biphenyls, Metabolism, Biochemistry, Cytological studies, Organic compounds, Chemical analysis, Oil, Bioassay, \*Ames System, \*Mutagens, \*Carcinogens.

Bacteria and fungi present in estuarine and marine water and sediment accomplish significant degradation of crude oil, refined oils, polychlorinated biphenyls, and organomercurials, with the rate and extent of degradation varying with species, geographic source, temperature, and other biologic and environmental parameters. Out biodegradation studies have been extended to determine if physical weathering and/or microbial degradation of oil by microorganisms present in Chesapeake Bay water and sediment produces potentially carcinogenic substances. Water and sediment from an area of Chesapeake Bay that receives heavy input of oil and from a relatively unpolluted site have been assayed for mutagenic ability of use of the Ames method, which is a bacterial assay and is highly sensitive. Preliminary findings indicate the presence of mutagenic substances in samples collected from the polluted site. Extract of oil subjected to microbial degradation under controlled laboratory conditions did not yield detectable mutagenic activity. In situ studies are in progress. (EIS-Katz)  
W78-12752

**SYSTEMATIC COLLABORATIVE STUDIES ON NEOPLASMS IN MARINE ANIMALS AS RELATED TO THE ENVIRONMENT.**  
British Columbia Univ., Vancouver. Cancer Research Centre.  
H. F. Stich, A. B. Acton, K. Oishi, F. Yamazaki, and T. Harada.  
Annals of the New York Academy of Sciences, Vol. 298, p 374-388, 1977. 9 fig, 40 ref.

This study reports on a world-wide survey of skin papillomas in flatfish. The frequency of skin papillomas was found to be higher in contaminated waters near populated area than in less polluted regions. Possible mechanisms for tumor genesis were presented. The usefulness of fish neoplasms as a carcinogen monitoring system was discussed. (EIS-Katz)  
W78-12753

**CHEMICAL POLLUTANTS IN RELATION TO DISEASES IN FISH.**  
Chicago Medical School, IL. Dept. of Microbiology.  
E. R. Brown, T. Sinclair, L. Keith, P. Beamer, and J. J. Hazdra.  
The Annals of the New York Academy of Sciences, Vol. 298, p 535-546, 1977. 6 tab, 7 ref.

Descriptors: \*Fish diseases, \*Water analysis, \*Disinfection, \*Cytological studies, Water pollution effects, Path of pollutants, Chemical analysis, Animal pathology, Organic compounds, Metals, Heavy metals, Toxicity, Mortality, Sewage effluents, \*Carcinogens, \*Tissue analysis, \*Neoplasma.

This paper discusses the following points: a chemical survey of two water systems (pollution-free Canadian 'Lake of the Woods' and polluted 'Fox River') and laboratory experiments that employed some chemicals, a brief summary of various fish diseases found in these watersheds, laboratory tests on chemical carcinogens, and interrelation-

ships of human pathogens to aquatic problems in the health field. (EIS-Katz)  
W78-12754

**EFFECTS OF CRUDE OIL INGESTION ON PLASMA OSMOREGULATION IN SALT-STRESSED WHITE PEKIN DUCKS (ANAS PLATYRHYNCHUS).**  
Mount Desert Island Biological Lab., Salsbury Cove, ME.  
D. S. Miller, C. J. Bunker, E. B. Burnham, M. C. Ratner, and D. B. Peakall.  
The Bulletin, Mount Desert Island, Biological Laboratory, Salsbury Cove, Maine, Vol. 16, p 79-80, 1976. 1 fig.

Descriptors: \*Oil, \*Oil spills, Water pollution effects, \*Animal physiology, Biochemistry, Laboratory tests, Domestic animals, Laboratory animals, \*Water birds, Pekin ducks, Kuwait Crude Oil, \*Osmoregulatory behavior.

To determine if petroleum hydrocarbons affect salt and water balance in white Pekin ducks, 0.2 ml of Kuwait crude oil was administered to Pekin ducks. Results indicate that petroleum induced osmoregulatory impairment in marine birds involves a slightly reduced capacity to obtain solute free water from 100% sea water and a delayed ability to recover when water of lower salinity is available. (EIS-Katz)  
W78-12755

**VARIATION IN TOXICITY TESTS OF RIVALE MOLLUSC LARVAE AS A FUNCTION OF TERMINATION TECHNIQUE.**  
Washington State Dept. of Fisheries, Brinnon. Shellfish Lab.-Point Whitney.  
For primary bibliographic entry see Field 5A. W78-12756

**EFFECTS OF CHLORDANE AND HEPTACHLOR ON THE MARINE DINOFLAGELLATE EXUVIELLA BALTICA LOHMANN.**  
State Univ. of New York at Stony Brook. Marine Sciences Research Center.  
B. Magnani, C. D. Powers, C. F. Wurster, and H. B. O'Connors, Jr.  
Bulletin of Environmental Contamination and Toxicology, Vol. 20, p 1-8, 1978. 3 fig, 1 tab, 16 ref.

Descriptors: \*Heptachlor, \*Chlorinated hydrocarbon pesticides, \*Dinoflagellates, Insecticides, Organic compounds, Pesticides, Phytoplankton, Growth rates, Chlorophyll, Productivity, Food webs, Cytological studies, Toxicity, Photosynthesis, Biomass, \*Chlordane.

Chlordane and heptachlor at 50 microg/l reduced cell density, chlorophyll a per unit volume of culture, 14C uptake per cell and carbon fixation per unit of chlorophyll a in the marine dinoflagellate *Exuviella baltica* Lohmann. The concentrations of chlorophyll a per cell was not reduced, however, by treatment with either compound. Chlordane was more toxic than heptachlor at this concentration, and caused the disintegration of many cells, thus affecting particle size distribution in the cultures. In nature, such an inhibition and shift in size class distribution could affect the availability of food for particle-feeding herbivores. (EIS-Deal)  
W78-12757

**THE EFFECT OF PRUDHOE BAY CRUDE OIL ON A TIDAL-FLAT ECOSYSTEM IN PORT VALDEX, ALASKA.**  
Alaska Univ., College Station.  
A. S. Naidu, H. M. Feder, and S. A. Norrell.  
In: Proceedings Tenth Annual Offshore Technology Conference, held in Houston, TX, May 8-11, 1978, Vol. 1, p 97-104, 1978. 2 fig, 2 tab, 18 ref. OTC No. 3055.

Descriptors: \*Sediments, Heavy metals, Resources Shelf, \*Tidal

The tidal flat... significant later... and biologic... deposits are... to clays with... bacterial cou... colony formi... per gram tim... are restricte... ment layers... and harpacti... spills in an o... in sediment... oxygen cont... not significa... 2000 ppm of... of low tides... and bacteria... tributed to t... surfaces. Ha... sely affecte... nificant inc... (Haleltonia)... oil dosages... the concentr... observed in... oiling of the... oil stranded... tively short... alters the se... nificantly to... adsorbed/ex... to the overly... W78-12803

**BEHAVIOR OF SPILL IN BUZZARDS.**  
For primary... W78-12806

**ENVIRONMENTAL IMPACTS OF BUCCANER VESTON, T. W. B. JACKSON.**  
In: Proceed... gy Conferen... 1978, Vol. 1... OTC No 30... Descriptors: \*Environme... \*Ecosystem... Water qual... Continental

In 1975, the Marine Fish... responsibility... parative env... and gas fiel... The Buccan... the study a... and produc... time for th... marine com... are determin... major com... cluding wa... matter, ic... pelagic fin... macro-crus... effluents ar... effects bio... ing alterati... biotic comm... of com... ponents of... being give... physicoche...

Descriptors: \*Water pollution effects, \*Sediments, \*Ecosystems, \*Alaska, Metals, Heavy metals, Copepods, Baseline studies, Resources development, \*Outer Continental Shelf, \*Tidal flats.

The tidal flat sediments of Port Valdez display significant lateral variations in lithological, chemical and biological subfacies. The glacially derived deposits are organically low poorly sorted gravels to clays with admixtures of sand and silt. Summer bacterial counts are relatively low with 243 aerobic colony forming units (CFU) and 30 anaerobic CFU per gram times 10 of sediment. Meiofaunal species are restricted to the upper 3-cm oxygenated sediment layers, and consist primarily of nematodes and harpacticoid copepods. Simulated crude oil spills in anoxic muddy site resulted in no changes in sediment organic carbon and in the dissolved oxygen contents. Bacterial populations were also not significantly affected by application of up to 2000 ppm of crude oil for several days at a series of low tides. The general lack of organic carbon and bacterial change in oiled sediments may be attributed to the rapid removal of oil from tidal flat surfaces. Harpacticoid copepods were not adversely affected by crude oil; on the other hand, a significant increase in density of one species (*Halectinosoma gothiceps*) was noted at chronic oil dosages. Nonetheless a significant decrease in the concentrations of Cu, Zn, Ni and V has been observed in the tidal deposits, subsequent to the oiling of the sediments. It is concluded that crude oil stranded on tidal flat surfaces even for a relatively short moment during tidal cycles probably alters the sediment pH and Eh relationships significantly to mobilize the heavy metals from the adsorbed/exchangeable sites of sediment particles to the overlying tidal waters. (Sinha-OEIS) W78-12803

#### BEHAVIOR OF THE BOUCHARD NO. 65 OIL SPILL IN THE ICE-COVERED WATERS OF BUZZARDS BAY,

For primary bibliographic entry see Field 5G. W78-12806

#### ENVIRONMENTAL ASSESSMENT OF THE BUCANEER OIL AND GAS FIELD OFF GALVESTON, TEXAS: AN OVERVIEW,

W. B. Jackson, K. N. Baxter, and C. W. Caillouet. In: Proceedings Tenth Annual Offshore Technology Conference, held in Houston, TX, May 8-11, 1978, Vol. 1, p. 277-284, 1978, 1 fig, 3 tab, 6 ref. OTC No 3081.

Descriptors: \*Water pollution effects, \*Environmental effects, \*Baseline studies, \*Ecosystems, Resources development, Oil spills, Water quality, Texas, Gulf of Mexico, \*Outer Continental Shelf, Drilling effluents.

In 1975, the Galveston Laboratory of the National Marine Fisheries Service (NMFS) was given responsibility for project management of a comparative environmental assessment of an active oil and gas field in the northwestern Gulf of Mexico. The Buceaneer Oil and Gas Field was selected as the study area because it has been in development and production since 1960, thus allowing ample time for the development of oilfield-associated marine communities. Present studies in this field are determining the concentration of pollutants in major components of the marine ecosystem, including water, sediment, suspended particulate matter, ichthyoplankton, sessile organisms, pelagic finfishes, and demersal finfishes and macro-crustaceans. Effects of oilfield discharge effluents are being assessed by acute and chronic effects bioassays on shrimp and fishes, by observing alteration of composition and abundance of biotic communities, and by investigating accumulation of contaminants in biotic and abiotic components of the ecosystem. Special attention is being given to food web dynamics and to physicochemical modes of transport of pollutants

into and away from the marine ecosystem in the field. (Sinha-OEIS) W78-12807

#### ASSESSMENT OF ENVIRONMENTAL IMPACT OF OFFSHORE PRODUCTION IN THE BUCANEER OIL FIELD: SEDIMENTOLOGIC AND GEOCHEMICAL RESULTS,

Rice Univ., Houston, TX. R. B. Wheeler, R. R. Schwarzer, and J. B. Anderson.

In: Proceedings Tenth Annual Offshore Technology Conference, held in Houston, TX, May 8-11, 1978, Vol. 1, p. 285-290, 1978, 3 fig, 2 tab, 13 ref, append. OTC No 3082.

Descriptors: \*Water pollution effects, \*Environmental effects, \*Sediments, \*Trace elements, Oil pollution, Geochemistry, Resources development, Texas, \*Outer Continental Shelf, Buceaneer Oil and Gas Field.

The Buceaneer oil/gas field, offshore Galveston, Texas, has been in operation for some 15 years and thus provides a good example of the effects of offshore exploration and production on the marine environment. As sediments are the ultimate sink for contaminants in the marine environment, a careful study of the sedimentology and trace element geochemistry of the sediments was performed. The intimate relationships between trace elements and sedimentary parameters such as grain size, clay mineralogy, organic carbon and carbonate content are discussed along with other important considerations regarding site selection, data interpretation, etc. Sediment samples collected near platforms are compared with control samples and/or BLM-STOCS data for concentrations of Ba, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Sr and Zn. There is evidence for Ba, Cd, Ni, Pb, Sr and Zn contamination of sediments in the study area. Possible sources of contamination related to exploration and production are enumerated and an attempt is made to relate contaminants to sources in the Buceaneer study area. (Sinha-OEIS) W78-12808

#### ENVIRONMENTAL HAZARDS ON THE ATLANTIC OUTER CONTINENTAL SHELF OF THE UNITED STATES,

For primary bibliographic entry see Field 6G. W78-12810

#### LEAD AND COPPER IN THE WATERS OF RARITAN AND LOWER NEW YORK BAYS,

National Marine Fisheries Service, Highlands, NJ. Middle Atlantic Coastal Fisheries Center. For primary bibliographic entry see Field 5B. W78-12811

#### SERIOUS MERCURY CONTAMINATION OF SEDIMENTS IN A NORWEGIAN SEMI-ENCLOSED BAY,

Norwegian Inst. for Water Research, Oslo (Norway). For primary bibliographic entry see Field 5B. W78-12815

#### ACUTE TOXICITY OF ALKYL LEADS TO SOME MARINE ORGANISMS,

Istituto di Ricerca Sulla Acque, Milano (Italy). R. Marchetti. Marine Pollution Bulletin, Vol 9, No 8, p 206-207, August 1978, 2 fig, 1 tab, 5 ref.

Descriptors: \*Water pollution effects, \*Toxicity, \*Metals, \*Lead, Environmental effects, Algae, Fish, Bacteria, Outer Continental Shelf, Alkyl lead, Adriatic Sea, Tetramethyl lead, Tetraethyl lead, Dunaliella tertiolecta, Artemia salina, Morone labrax.

Following the wreck of the cargo ship Cavtat in the Adriatic Sea and the danger of pollution by alkyl lead antiknock compounds, the acute toxicity of alkyl leads to marine organisms at different trophic levels has been determined in the laboratory. The shipment included 325 metric tons of three different alkyl lead antiknock formulations. Although toxic effects of inorganic lead are fairly well known, the effects of alkyl lead compounds are almost completely unknown. This report refers to the acute toxicity of tetramethyl lead and tetraethyl lead determined for some marine organisms belonging to different trophic levels. (Sinha-OEIS) W78-12816

#### POLAR CONTINENTAL SHELF PROJECT. TITLES AND ABSTRACTS OF SCIENTIFIC PAPERS SUPPORTED BY PCSF.

Department of Energy, Mines and Resources, Ottawa (Ontario) Polar Continental Shelf Project. Canada Department of Energy, Mines and Resources, Polar Continental Shelf Project, 'Titles and Abstracts of Scientific Papers', Vol 3, December 1977, 191 p. Hobson, G. D. and Voyce, J. (compilers).

Descriptors: \*Polar Regions, \*Baseline studies, \*Water pollution effects, \*Bibliographies, Oil spills, Arctic, Resources development, Water quality, Outer Continental Shelf, Polar Continental Shelf Project.

This bibliography of 1090 references provides abstracts to the world literature on the nature of the Polar Regions to serve as a frame of reference in the study of the effects of pollution on the Arctic environment. (Sinha-OEIS) W78-12819

#### THE EFFECTS OF THE OCEAN DISPOSAL OF MUNICIPAL WASTES.

Southern California Coastal Water Research Project, El Segundo. Southern California Coastal Water Research Project Report, 'The Effects of the Ocean Disposal of Municipal Wastes,' 1978, 27 p, append.

Descriptors: \*Waste disposal, \*Water pollution effects, \*Water quality, California, Outfall sewers, Metals, Industrial wastes, Municipal wastes, \*Outer Continental Shelf, \*Ocean dumping.

The Project has collected and published data on the quantity and kind of materials discharged through the six principal outfall pipes since 1971. The objective of this report is to communicate the Project's essential ideas, findings, and recommendations to the general public. During the past 7 years, there has been a substantial reduction in the levels of the two most important pollutants—the pesticide DDT and the polychlorinated biphenyls (PCB's). There has also been a drop of at least 20% in emission of most trace metals, oil and grease, and ammonia nitrogen. Emissions of chromium and zinc have decreased approximately 50% during this period. Among the recommendations are: useful foods and nutrients, such as those contained in human wastes, should not be prevented from reaching the sea, as long as the amounts of these substances do not build up on the ocean bottom; metals in wastes at the present levels have not been found to cause damage to marine life and unless such damage can be demonstrated, no improvement in controlling metals is needed; more research is needed in several areas that have been identified by the work to date; and the most sensible public policy relating to waste disposal is to take whatever actions are least damaging to the overall environment. W78-12820

#### NATURAL RADON AND PHOSPHORUS AS LIMNOLOGIC TRACERS: HORIZONTAL AND



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**VERTICAL EDDY DIFFUSION IN GREIFEN-SEE,**  
Eidgenössische Technische Hochschule, Zurich  
(Switzerland).  
For primary bibliographic entry see Field 5B.  
W78-12849

**EXPERIMENTAL AND FIELD STUDIES ON ECOLOGICAL ENERGETICS OF ASELLUS AQUATICUS L. (ISOPODA), III. POPULATION DYNAMICS ON THE BACKGROUND OF MACROBENTHOS OCCURRENCE IN THE LITTORAL ZONE OF POWINSKIE LAKE,**  
Polish Academy of Sciences, Warsaw (Poland).  
Dept. of Ecological Bioenergetics.  
T. Prus.  
Ekologia Polska, Vol. 25, No. 1, p 59-74, 1977. 8 fig, 2 tab, 8 ref.

**Descriptors:** \*Powsinskie Lake(Poland), \*Macrobenthos, \*Benthic fauna, \*Asellus aquaticus, \*Crustaceans, \*Life history studies, \*Population dynamics, Lakes, Poland, Invertebrates, Age, Sex, Size, Seasonal, Eutrophication, Isopods, Heat budget, Littoral, Energy budget.

A general outline of seasonal and annual changes in macrobenthos occurrence in highly eutrophic Powinskie Lake, Poland, focuses on the isopod crustacean *Asellus aquaticus*. Changes in numbers, biomass, and caloric equivalent of benthic invertebrates (except Mollusca) provide background information on population dynamics of *A. aquaticus*. Age, sex, and size structure of *A. aquaticus* were investigated; population, abundant in spring (2700/sq m), declined during summer (100/sq m) and tended to increase again in autumn. A long-term population decline over the three-year study period (1972-74) was noted, however. A total of 1310 samples were collected over the six-to-seven month vegetation seasons (about April-October) at four stations. Maximum occurrence of both *A. aquaticus* and the total macrobenthos community was in June; maximum density of *A. aquaticus* was 2700 individuals/sq m, biomass (dry wt) was 1.7 g/sq m, and caloric equivalent was 4.5 kcal/sq m, while for the community maximum density was 18,000/sq m, dry wt was 7 g/sq m, and caloric equivalent was 35 kcal/sq m. *A. aquaticus* formed 10-20% of total macrobenthos during peak occurrence, and 5-10% during other periods. The abrupt and permanent decline of *A. aquaticus* was probably due to a natural population pattern, but other possible causes include: (1) pesticide pollution, (2) migration due to bottom oxygen depletion, or (3) predation. (Lynch-Wisconsin)  
W78-12865

**THE ECOLOGY OF ROACH, RUTILUS (L.), IN THE BARBEL REGION OF THE POLLUTED PILICA RIVER. III. LIPIDS, PROTEIN, TOTAL NITROGEN AND CALORICITY,**  
Lodz Univ. (Poland). Inst. of Environmental Biology.  
T. Penczak, M. Molinski, E. Kusto, B. Ichinowska, and M. Zalewski.  
Ekologia Polska, Vol. 25, No. 1, p 75-88, 1977. 1 fig, 3 tab, 33 ref.

**Descriptors:** \*Roach, \*Rutilus rutilus, \*Water pollution effects, \*Pilica River(Poland), \*Lipids, Fish, Poland, Sex, Age, Rivers, Sewage disposal, Seasonal, Caloricity, Proteins, Weight, Nitrogen, Electro-fishing.

A study of the effects of different levels of sewage pollution at two sites in the Pilica River, Poland, on lipid and protein level and body caloricity in the cyprinid fish *Rutilus rutilus* (roach) showed a statistically significant correlation only with season, although observable effects of sewage concentration were recorded. Age and sex did not correlate. Weight, hydration, body caloricity, and lipid weight were also investigated for statistical relationship. Body caloricity of roaches at more

heavily polluted Site 2 was higher than at Site 1, but the difference was not statistically significant. A statistically significant positive correlation was found between body weight and weight of lipids, and a significant negative correlation was found between body hydration and percentage of lipids. A positive (but not statistically significant) correlation was also found between increase of lipids and increase of body caloricity. Lipid level and body caloricity were highest in autumn, and lowest in January-March. Lipids in all age groups decreased strongly but temporarily in September. The 474 roach specimens analyzed in the study were caught in nine electro-fishings at the two study sites, which differed by one class of water pollution according to Polish water quality standards. (Lynch-Wisconsin)  
W78-12866

**MICROBIOLOGICAL STUDIES ON THE NITROGEN CYCLE IN AQUATIC ENVIRONMENTS - IV, METABOLIC RATE OF AMMONIUM NITROGEN IN FRESHWATER REGIONS,**  
Kyoto Inst. of Oceanic and Fishery Science (Japan).  
M. Sugiyama, and A. Kawai.  
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 4, p 351-355, 1978. 7 fig, 2 tab, 5 ref.

**Descriptors:** \*Ammonium compounds, \*Nitrogen cycle, \*Metabolism, \*Ponds, \*Dissolved oxygen, Fish farming, Aeration, Tracers, Nitrogen, Freshwater, Ammonia, Denitrification, Organic matter, Mitsuie Pond(Japan), Japan, Kawachibuna, Carassius cuvieri, Mud, Bacteria, Domestic wastes.

A fish-culturing pond in Japan and experimental aquaria with and without aeration were used to clarify the pathways of ammonium nitrogen and to estimate the rate of each process in freshwater with different levels of dissolved oxygen. The turnover rate of ammonium nitrogen was estimated to be 2.9%/hr in the pond, 4.5%/hr in the aerated aquarium, and 0.6% in the stationary aquarium. The metabolic rate of nitrogenous compounds was reflected in water quality. A high rate of ammonia oxidation was observed in water bodies with high dissolved oxygen levels, while denitrification proceeded more rapidly in water which lacked sufficient dissolved oxygen. The field experiment was conducted in Mitsuie Pond, Neyagawa, Osaka, Japan, in which Kawachibuna (*Carassius cuvieri*) has been cultivated with an aeration system. The pond is about 0.73 ha in area, has a depth of about 1.4 m, and is located at the edge of a residential area from which it receives domestic wastewater. The aquaria contained bottom mud, but the pond was too deep to include mud in the experiment. Bacteria in water and bottom mud were identified, and water and mud quality determined. For metabolic rate measurement the nitrogen-15 tracer technique was used. The field test was carried out in a transparent polyethylene bag suspended in the pond, supplemented with ammonium sulfate with heavy nitrogen. (See also W77-12878 and W72-07948) (Lynch-Wisconsin)  
W78-12867

**FURTHER STUDIES OF PLANKTON ECOSYSTEMS IN THE EASTERN INDIAN OCEAN IV. NUMERICAL TREATMENT IN SITE-SPECIES DATA,**  
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Mathematics and Statistics.  
For primary bibliographic entry see Field 5A.  
W78-12868

**FURTHER STUDIES OF PLANKTON ECOSYSTEMS IN THE EASTERN INDIAN OCEAN VIII. SEASONAL, DIURNAL, AND LATITUDINAL VARIATIONS IN ABUNDANCE**

**OF EUTHECOSOMATA ALONG THE 110 DEGREE E. MERIDIAN,**  
Marine Products Export Development Authority, Calcutta (India).  
M. Sakthivel.  
Australian Journal of Marine and Freshwater Research, Vol. 28, No. 5, p 663-671, 1977. 1 fig, 1 tab, 13 ref.

**Descriptors:** \*Abundance, \*Zooplankton, \*Euthecosomata, \*Indian Ocean, \*Species composition, \*Seasonal, Mollusks, Vertical migration, Ecosystems, Distribution patterns, Diurnal, Latitudinal studies, Oceans, *Creseis virgula*, *Hyalocylis striata*, *Diacria quadridentata*, *Cavolinia*, *Limacina*, *Styliola subula*, *Cuvierina columnella*, *Clio pyramidata*.

Zooplankton were sampled at 16 stations along the 110 degree E. meridian by vertical hauls ranging in depth from 200 m to the surface at about midday and midnight to determine seasonal variations of Euthecosomata in tropical and subtropical parts of the southeastern Indian Ocean. Records of 18 species monitored seasonally and diurnally are available as an accessory publication. Three groups of species were identified: (1) species of tropical dominance, (2) species of subtropical dominance, and (3) species of both tropical and subtropical dominance (warm-water cosmopolites). Several species reached peak abundance in the northern tropical water mass between 9 and 20 degrees S. during the southeast monsoon (May-September), including *Creseis virgula*, *Hyalocylis striata*, *Diacria quadridentata*, and *Cavolinia longirostris*. The maximum abundance of these species was north of 14 degrees N. A few species reached maximum abundance at other times of the year in the subtropical water mass south of 20 degrees S., such as *Limacina lesueuri*, *Styliola subula*, *Cuvierina columnella*, and *Cavolinia inflexa*. *Limacina bulimoides* was at maximum around 14 degrees S. during September-November, with a second maximum around 23 degrees S. during different months. Nocturnal increase in occurrence and abundance was observed in *L. lesueuri*, *L. helicina rangii*, *Clio pyramidata*, *C. p. lanceolata*, *S. subula*, *Cuvierina columnella*, *D. quadridentata*, and *Cavolinia inflexa*. (See also W78-12868) (Lynch-Wisconsin)  
W78-12869

**STUDIES ON COPPER METABOLISM IN FISHES-II. THE SITE OF COPPER ACCUMULATION IN THE TISSUES OF CARP (IN JAPANESE),**  
Kyoto Univ. (Japan). Dept. of Fisheries.  
Y. Yamamoto, T. Ishii, and S. Ikeda.  
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 43, No. 11, p 1327-1332, 1977. 23 ref, 2 fig, 4 tab.

**Descriptors:** \*Carp, \*Copper, \*Fish physiology, \*Proteins, \*Biochemistry, \*Metals, \*Bioassay, \*Absorption, Laboratory tests, Metabolism, Nutrients, Separation techniques, Animal physiology, Cytological studies, \*Bioaccumulation, Tissue analysis, \*Ceruleoplasmin, \*Hepatopancreas.

The site of copper accumulation was investigated in carp exposed to 0.1 ppm copper solution for 2 weeks. Ceruloplasmin and direct-reacting copper contents in the serum of copper-exposed carp significantly increased as compared to those of normal carp. By copper loading, a statistically apparent increase of copper content was observed in the hepatopancreas, gills, intestine, and kidney. Among these tissues, the highest copper content was found in the hepatopancreas. In the hepatopancreas, more than 70% of the copper was found in the supernatant fraction. Little, if any, copper was found in the ultrafiltrate from the supernatant treated with DIAFLO UM-2 membrane. Sephadex G-75 gel filtration analysis of the supernatant fraction demonstrated that the most part of copper accumulated in the hepatopancreas was

bound to the relatively lower molecular weight protein. (EISTKatz)  
W78-12870

# METAL TOXICITY TO EMBRYOS AND LARVAE OF EIGHT SPECIES OF FRESHWATER FISH - II. COPPER,

Environmental Research Lab., Duluth, MN.  
J. M. McKim, J. G. Eaton, and G. W. Holcombe.  
Bulletin of Environmental Contamination and Toxicology, Vol. 19, p 608-616, 1978. 3 fig, 2 tab, 14 ref.

Descriptors: \*Copper, \*Toxicity, \*Larval growth stage, \*Juvenile growth stage, \*Embryonic growth stage, \*Rainbow trout, \*Brown trout, \*Lake trout, \*Brook trout, \*Herrings, \*Pikes, \*Mortality, \*Growth rates, \*Fish physiology, \*Biomass, \*Growth stages, \*Freshwater fish, \*Water pollution effects, \*Sensitivity

Fish larvae and early juveniles of all species tested (brook trout, rainbow trout, brown trout, lake trout, northern pike, white sucker, herring, and smallmouth bass) were more sensitive to copper than the embryos. Embryo survival was affected only at the higher concentrations tested, for all species except the rainbow trout. The concentrations of copper that caused significant effects on the larval standing crop were similar for all species except the northern pike, which seemed to be considerably more resistant. Copper concentrations shown to have no significant effects on the early developmental stages of these species are considered close estimates of the copper concentrations that would have no measurable adverse effects during a complete life cycle toxicity test under similar test conditions. (See also W78-06151) (EIS-Deal)  
W78-12874

# ECONOMIC ASPECTS OF THE EFFECTS OF POLLUTION ON THE MARINE AND ANADROMOUS FISHERIES OF THE WESTERN UNITED STATES OF AMERICA,

Food and Agriculture Organization of the United Nations, Rome (Italy). Dept. of Fisheries.  
For primary bibliographic entry see Field 5G.  
W78-12876

# CHLOROPLAST PIGMENTS OF A GREEN PHYTOPLANKTON FROM THE HUDSON ESTUARY, U.S.A.,

Dalhousie Univ., Halifax (Nova Scotia) Dept. of Oceanography.  
S. S. Bates, and J. S. Craigie.  
Phycologia, Vol. 17, No. 1, p 79-84, 1978. 3 fig, 3 tab, 29 ref.

Descriptors: \*Hudson River, \*Phytoplankton, \*Chlorophyta, \*Chloroplasts, \*Pigments, \*HR-1, \*Classification, \*Estuaries, algae, Chlorophyll, Carotenes, Xanthophylls, Identification, Rivers, Extraction.

Extraction and chromatographic fractionation of chloroplast pigments from a nonmotile green phytoplankton, HR-1, isolated from the lower Hudson River, New York in December 1972, provided a basis for assigning the algae to the Chlorophyceae. The 5-micrometer diameter non-flagellated phytoplankton has been studied with respect to effects of light intensity and ammonium on nitrate uptake, but has not yet been assigned to a genus or species. Observations by light microscopy were inconclusive, due to its similarity to members of several algal classes. Analysis revealed chlorophylls-a and -b, beta-carotene, lutein, violaxanthin, and neoxanthin. Chromatographic properties and visible absorption maxima are reported for two minor unidentified carotenoids, one of which occurred in the carotene fraction. The presence of chlorophyll-b and three xanthophylls associated with Chlorophyceae justify assignment to this class. This study reports a

procedure successfully used to extract pigments from this thick-walled chlorophyte. Pigment extraction consisted of boiling cells for three min in five ml distilled water with three ml of 1% w/v magnesium carbonate, then cooling immediately in an ice bath. After centrifugation the water was decanted and replaced with absolute methanol. Pigments were extracted from the pellet after 30 min in cold and darkness. (Lynch-Wisconsin)  
W78-12884

# DENITRIFICATION OF AMMONIA FORMATION IN ANAEROBIC COASTAL SEDIMENTS,

Tokyo Univ. (Japan). Ocean Research Inst.  
I. Koike, and A. Hattori.  
Applied and Environmental Microbiology, Vol. 35, No. 2, p 278-282, February 1978. 1 fig, 3 tab, 17 ref.

Descriptors: \*Sediments, \*Anaerobic conditions, \*Denitrification, \*Ammonia, \*Nitrogen, \*Path of pollutants, Coasts, Mangoku-Ura (Japan), Simoda Bay (Japan), Tokyo Bay (Japan), Japan, Tracers, Radioisotopes, Nitrates, Particulate organic nitrogen, Cycling nutrients, Nutrient flux, Eutrophication, Bays, Microorganisms, Bacteria, Sediment-water interfaces.

Nitrogen-15 tracing was used to simultaneously determine nitrogen gas production, ammonia, and particulate organic nitrogen (PON) formation in coastal sediments of Mangoku-Ura, Simoda Bay, and Tokyo Bay, Japan. Transformation of nitrogen and its recycling in coastal sediments contribute significantly to eutrophication in coastal areas, but there is little quantitative information on denitrification in marine sediment. In the sediment surface layer the rate of nitrogen gas production was about 0.1 microgram atom of N/g/hr, irrespective of sediment location. Nitrogen-15 ammonia and PON accounted for 20-70% of the three products; after several hours of incubation, the major fraction of nondenitrified nitrogen-15 in Mangoku-Ura and Simoda Bay sediments was recovered as ammonia. In Tokyo Bay sediments, PON was produced at a greater rate than ammonia. The reduction rate data suggest that the pathway of nitrate reduction to ammonia is important in coastal sediments. Samples were collected from deep sediments with a Phleger corer, and from shallow sediments by divers with plastic tubes. Organic nitrogen contents ranged from 0.56-7.8 mg N/g. The water above Tokyo Bay sediments was anoxic, but in the other area oxygen was present. Bacterial denitrification in coastal sediments is about proportional to nitrate concentrations in the range of 0-30 microgram atom of N/liter.  
W78-12885

# GROWTH OF HETEROTROPHIC BACTERIA AND ALGAL EXTRACELLULAR PRODUCTS IN OLIGOTROPHIC WATERS,

Montana State Univ., Bozeman. Dept. of Microbiology.  
G. A. McFeters, S. A. Stuart, and S. B. Olson.  
Applied and Environmental Microbiology, Vol. 35, No. 2, p 383-391, February 1978. 5 fig, 1 tab, 40 ref. CX-12004B025, CX-6000-3-087 and 292-0-P20067.

Descriptors: \*Bacteria, \*Heterotrophic bacteria, \*Coliforms, \*Chlorella, \*Bioindicators, \*Biological communities, Grand Teton National Park (WY), Wyoming, National Parks, Oligotrophy, Streams, Ecology, Mountains, Garnet Creek (NY), Water pollution sources, Benthic flora, Symbiosis, Organic matter, Algae, Carbon radioisotopes, Tracers, Human diseases, Water quality control.

A study of a community of Chlorella algae and coliform bacteria in an alpine stream in Grand Teton National Park, Wyoming suggests that substantial numbers of coliform bacteria may be found in uncontaminated waters without the

presence of warm-blooded animals. These findings indicate use of coliforms as sanitary indicators is not always valid and the potentially pathogenic bacteria, such as enteropathogenic *E. coli* and *Klebsiella* species, could originate in an unpolluted environment. During a 1973-75 surveillance program in the park total coliform bacterial counts were low in most waters studied, but in the outlet stream of Surprise Lake (altitude 2916 m) coliform counts were consistently greater than 200 per 100 ml in midsummer. The pristine stream flows a vertical distance of 234 m before entering Garnet Creek; fauna is limited to marmots and picas. Although no obvious source of elevated bacterial counts was found, emergence of a benthic algal community containing *Gleocapsa*, *Stigonema*, and *Chlorella* coincided with high coliform counts in late July-August. Bacteria grown under laboratory conditions in supernatant from *Chlorella* culture increased by 2-3 orders of magnitude at 13°C. Radioactive organic products from *Chlorella* fed carbon-14 labelled bicarbonate became incorporated into the particulate fraction of coliforms as they reproduced, and were released as they died. (Lynch-Wisconsin)  
W78-12886

# THE ROLE OF SURFACE AND EXTRACELLULAR PHOSPHATASES IN THE PHOSPHORUS REQUIREMENT OF OCHROMONAS,

Queens Coll., Flushing, NY. Dept. of Biology.  
S. Aaronson, and N. J. Patni.  
Limnology and Oceanography, Vol. 21, No. 6, p 838-845, 1976. 9 tab, 55 ref. NSF GB 20825.

Descriptors: \*Phosphorus, \*Ochromonas danica, \*Phosphomonoesterases, \*Algae, \*Nutrients, Phosphatases, Organic compounds, Inorganic compounds, Phosphates, Surfaces, Extracellular, Secretion.

Previous research shows that algae and other microorganisms have phosphomonoesterases (PME) at their surface or secrete them into their environment. This paper demonstrates how surface or extracellular PME may function in an alga's phosphorus metabolism using the chrysomonad *Ochromonas danica* as a model. Results show that acid and alkaline PME activity of phosphorus-depleted *O. danica* can be partially but not completely repressed by exogenous inorganic phosphate (Pi). Acid and alkaline PME activity was found in the plasma membrane as well as the cytosol, and acid PME was secreted into the cell's environment. Extracellular and surface PME could provide the necessary phosphate for the growth of phosphorus-depleted algae in the presence of organic phosphates; specific organic phosphates, glucose-1-phosphate (G-1-P) and glucose-6-phosphate (G-6-P), supported growth with small inocula. Other organic phosphates were inactive. G-1-P and G-6-P induced almost double the normal secretion, and this extra secretion is shown to be sufficient to provide for the growth of phosphorus-depleted cells inoculated in relatively small numbers. In the tests *O. danica* was maintained in the medium of Aaronson and Baker, and phosphorus-depleted cultures were prepared by growing the culture in low orthophosphate (Pi; 0.011 mM) medium for at least two months. (Lynch-Wisconsin)  
W78-12887

# COMPARISON OF LIGHT AND ELECTRON MICROSCOPIC DETERMINATIONS OF THE NUMBER OF BACTERIA AND ALGAE IN LAKE WATER,

Lund Univ., (Sweden). Dept. of Microbiology.  
For primary bibliographic entry see Field 5A.  
W78-12888

# THE DISTRIBUTION OF NUTRIENTS IN SWARTVLEI, A SOUTHERN CAPE COASTAL LAKE,

Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

For primary bibliographic entry see Field 5B.  
W78-12889

#### SIGNIFICANCE OF PREDATOR INFLUENCE ON COMPOSITION OF BOSMINA SPP. POPULATIONS.

Goteborg Univ. (Sweden). Dept. of Zoology.  
J. A. E. Stenson.  
Limnology and Oceanography, Vol 21, No. 6, p 814-822, November 1976. 4 fig, 6 tab, 31 ref.

Descriptors: \*Bosmina coregoni, \*Bosmina longirostris, \*Predation, Fish, Size, \*Bioindicators, Cladocerans, Zooplankton, Crustaceans, Net plankton, Perch, Perca fluviatilis, Roach, Leuciscus rutilus, Sweden, Lakes, Trophic level, Eutrophication, Oligotrophy.

Fish in eight small Swedish lakes of very similar physical and chemical characteristics clearly preferred the larger of two species of the cladoceran genus *Bosmina*, *B. coregoni*. *B. coregoni* and *B. longirostris* have been regarded as trophic indicators, with *B. coregoni* associated with oligotrophic and *B. longirostris* with eutrophic waters. These findings show that vertebrate and invertebrate predators may influence distribution and numeric relations between the two species. Lakes number one, two, three, six and eight have dense reproducing fish populations dominated by perch and roach, while lakes number four, five and seven have scarce non-reproducing salmonid populations. Comparison of fish and net plankton samples showed the fish preferred *B. coregoni*, regardless of the relative proportions of the two species in the surrounding water. *Bosmina* was never found in salmonids' stomachs, but was present in 114 of 486 perch and roach stomachs between 1970-72. The mean size of *Bosmina* was higher in salmonid lakes as expected, and *B. longirostris* was dominant in the perch and roach lakes (with the exception of lake eight, where predation was less than in the other perch and roach lakes). Absolute abundance differed similarly, with numbers of *B. longirostris* higher in the perch and roach lakes. The greater abundance of *B. longirostris* in lakes with higher fish predation appears due to predation of these fish on larger invertebrates which either feed on or compete with *B. longirostris*. (Lynch-Wisconsin) W78-12890

#### VERTICAL MIGRATION IN ZOOPLANKTON AS A PREDATOR AVOIDANCE MECHANISM.

Washington Univ., Seattle. Dept. of Zoology.  
T. M. Zaret, and J. S. Suffer.  
Limnology and Oceanography, Vol. 21, No. 6, p 804-813, November 1976. 4 fig, 4 tab, 40 ref. NSF GB 12557.

Descriptors: \*Zooplankton, \*Vertical migration, \*Diel migration, \*Predation, \*Copepods, \*Light, Fish, \*Gatun Lake (Panama), \*Panama, \*Fuller Pond (CN), \*Connecticut, Lakes, Ponds, Adaptation, Diaptomus gatunensis, Diaptomus galeata mendotae, Melaniris chagresi, Notemigonus crysoleucas, Golden shiner, Seasonal, Biorhythms, Seasonal, Food habits

Field data from Gatun Lake, Panama, and Fuller Pond, Connecticut, and laboratory feeding experiments support the hypothesis that vertical migration among zooplankton is related to adaptation to visually-dependent predation. In the two cases studied the diel vertical migration of copepod species appeared to respond to intense selective pressures from fish predators dependent on sufficient light for feeding. In unstratified Gatun Lake, the calanoid copepod *Diaptomus gatunensis* is dominant numerically and in terms of total biomass and is the largest potential food item; but it was rarely found in stomach contents of the dominant planktivorous fish, *Melaniris chagresi*. Laboratory tests showed *M. chagresi* capable of eating *D. gatunensis*. Investigation of *D. gatunensis* diel vertical migration showed adults concentrated just above

sediments during the daytime when *M. chagresi* is able to feed, and in the top four m of surface water just after dusk. In addition, migration response of adults, copepodids, and nauplii reflect relative food preferences of the fish. In Fuller Pond only *Diaptomus galeata mendotae* is an important prey organism for the dominant planktivore *Notemigonus crysoleucas* (golden shiner). Vertical migration patterns of *D. galeata mendotae* similarly responded to feeding activity of the visually-dependent predator. Seasonal changes in predation intensity were also correlated with vertical migration. (Lynch-Wisconsin) W78-12891

#### SOME CONSEQUENCES OF DISTRIBUTIONAL HETEROGENEITY OF PHYTOPLANKTON AND ZOOPLANKTON.

California Univ., San Diego, La Jolla. Inst. of Marine Resources.  
M. M. Mullin, and E. R. Brooks.  
Limnology and Oceanography, Vol 21, No. 6, p 784-796, November 1976. 4 fig, 3 tab, 28 ref. ERDA AT(11-1) GEN 10, P.A. 20.

Descriptors: \*Homogeneity, \*Heterogeneity, \*Phytoplankton, \*Zooplankton, \*Methodology, \*Model studies, *Calanus pacificus*, Copepods, Distribution, Respiration, Feeding rates, Food habits, Biomass, Grazing, Vertical distribution, Carbon, Primary production, Euphotic zone.

This study critically examines assumption of homogeneous distribution of phytoplankton and zooplankton commonly utilized in simple models of plankton dynamics, and assesses computational consequences of possible heterogeneous distribution. As an illustration, the effects of heterogeneity on simple calculation of zooplankton ingestion rate are presented, and the range of rates likely to be found at any one time is described. Measurements of small-scale vertical distribution of phytoplankton and the copepod *Calanus pacificus* were used to determine food biomass available to an average animal, and to test the assumption of homogeneity. At many points sampled, the copepod population was apparently not able to meet its metabolic requirement, and ecological consequences are deemed dependent on the rapidly with which turbulence, imbalance of primary production and grazing, and vertical plant and animal movement rearrange the spatial pattern of malnutrition and surplus. Some possibly oversimplified assumptions of homogeneity included in models are: (1) Phytoplankton growth occurs in a thoroughly mixed and homogeneous euphotic zone. (2) Such growth is governed by mean light intensity, mean temperature, and mean nutrient concentration. (3) Biological processes affecting phytoplankton and zooplankton biomass occur at the same rate throughout the euphotic zone and over a wide horizontal area. (4) All phytoplankton are equally available to, and nutritious for, zooplankters. (Lynch-Wisconsin) W78-12892

#### NITROGEN AND PHOSPHORUS INPUT TO THE MIDMAR DAM, NATAL.

National Inst. for Water Research, Cogella, (South Africa).  
J. Hemens, D. E. Simpson, and R. J. Warwick.  
Water SA, Vol 3, No 4, p 193-201, October 1977. 3 fig, 5 tab, 25 ref.

Descriptors: \*Nitrogen, \*Phosphorus, \*Midmar Dam (South Africa), \*Impoundments, \*Nutrients, Natal (South Africa), South Africa, Oligotrophy, Mesotrophy, Trophic level, Algae, Fallout, Runoff, Vollenweider models, Water quality indices.

Nitrogen and phosphorus inputs to Midmar Dam, the uppermost impoundment in the Umgeni catchment, Natal Province, South Africa, are given. The Umgeni basin is the most heavily utilized water source in the province. Although Umgeni River water was of generally good quality in a

1967 survey, rapid urban and industrial development in the basin has made assessment of nutrient enrichment in the impoundments necessary. In March 1973-February 1974 the mass of nutrients carried to the dam by surface drainage was equivalent to a surface loading rate of 0.62 g total phosphorus and 8.49 g total soluble nitrogen/sq m/yr. Mean annual rate for phosphorus is probably about half this value. Algal growth in dam water during this period was phosphorus limited. Atmospheric nutrient deposition in the dam catchment, measured in 1975-76, probably provides a small but significant contribution to total annual input. Most of the nutrients reaching the land surface are retained in vegetation and soil of the catchment. The Midmar Dam was classified oligotrophic-mesotrophic on the basis of the modified Vollenweider eutrophication model (1972), guidelines proposed by the U.S. National Eutrophication Survey, and a tentative classification developed by Toerien, et al (1975). An increase in total phosphorus input to 0.5 g/sq m/yr could probably be tolerated without development of algal blooms at the present mean hydraulic residence time of one year. (Lynch-Wisconsin) W78-12893

#### NUMBERS AND BIOMASS OF THE LITTORAL FAUNA IN MIKOLAJSKIE LAKE AND IN OTHER MASURIAN LAKES.

Polish Academy of Science, Warsaw. Dept. of Hydrobiology.  
E. Pieczynski.  
Ekologia Polska, Vol 25, No 1, p 45-57, 1977. 5 fig, 5 tab, 10 ref.

Descriptors: \*Mikolajskie Lake (Poland), \*Littoral, \*Benthic fauna, \*Periphyton, \*Habitats, \*Abundance, \*Biomass, \*Species composition, \*Dominance, Lakes, Lake Beldany (Poland), Lake Flosek (Poland), Lake Snardwy (Poland), Lake Taltowisko (Poland), Lake Talty-Rynskie (Poland), Seasonal, Invertebrates, *Phragmites communis*, *Schoenoplectus lacustris*.

Seasonal abundance and biomass of benthic and macroperiphytonic invertebrate fauna of littoral habitats in Mikolajskie Lake and five other Masurian lakes (Poland) were studied June 1971-October 1972. Abundance and biomass of benthic fauna were much higher in littoral habitats overgrown by emergent macrophytes. Macroperiphytonic fauna living on reeds (*Phragmites communis*) dominated over fauna living on bulrushes (*Schoenoplectus lacustris*), both in terms of numbers and biomass. In shallow littoral habitats, benthic fauna were higher in numbers and in biomass than macroperiphytonic fauna. Seasonal changes in numbers and dominance of benthos were different in each littoral habitat, and varied also over the two study years. Abundance of macroperiphytonic fauna likewise varied seasonally and biennially, but dominance on both reeds and bulrushes was relatively consistent, with a preponderance of Chironomidae. In Mikolajskie Lake three sites were sampled monthly, while sampling was conducted only once in Lakes Beldany, Flosek, Snardwy, Taltowisko, and Talty-Rynskie. The three Mikolajskie Lake habitats, all about 0.5 m deep, were: (1) littoral without emergent macrophytes, high exposure to waves, sand and mud bottom; (2) littoral overgrown by bulrush, low wave exposure, mud and sand bottom; and (3) littoral overgrown by reed, medium wave exposure, hard sandy and stony bottom with a thin mud layer. (Lynch-Wisconsin) W78-12894

#### NORTH AMERICAN PROJECT-A STUDY OF U.S. WATER BODIES.

Corvallis Environmental Research Lab., OR.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 674. Price codes: A24 in paper copy, A01 in microfiche. Publication No EPA-00/3-77-086, July 1977. 537 p.



93 fig, 215 tab. Seyb, L. and Randolph, K., compilers. 1 BA031.

Descriptors: \*United States, \*Lakes, \*Trophic level, \*Eutrophication, Limnology, \*Nutrients, \*Indicators, Water management, Basic data collections, Impoundments, Phytoplankton, Algae, Primary productivity, Bioindicators, Vollenweider models, Sewage disposal, Hydraulic residence time, Limiting factors, Phosphorus, Model studies, Water quality indices, Runoff, Diversion, Water pollution control, Water pollution effects, Watersheds(Basins), Oligotrophy, Mesotrophy.

Twenty-one papers analyze the limnology of 22 water bodies in the United States (primarily lakes), compiled for the Water Management Sector Group of the Organization for Economic Cooperation and Development. In 1971 the Water Management Sector Group established a steering group on eutrophication control to develop a series of cooperative projects for monitoring eutrophication in inland waters; this volume covers the North American Project, United States section. A major goal was comparability of data on nutrient budgets, chemical balances, and biological productivity in water bodies, reflected in the standardized format of each paper. The following are generally discussed: (1) geography, (2) morphometry and hydrology, (3) limnology, and (4) nutrient budgets. There is usually an attempt to determine the trophic status of the water body being studied, often employing the Vollenweider plot of phosphorus loading as a function of mean depth/hydraulic residence time. Other indicators of trophic state are also used. The studies include recommendations for optimal eutrophication control strategies. Papers are divided into sections on Florida (one paper), Minnesota (five papers), New York (three papers), Ohio (one paper), Oregon (one paper), Washington (two papers), Wisconsin (three papers), and Multiple-State Lakes and Special Topics (five papers). All studies deal with lakes and impoundments, with the exception of one on the Potomac Estuary. (See also W78-12896 thru W78-12915) (Lynch-Wisconsin) W78-12895

#### ANALYSIS OF TROPHIC CONDITIONS AND EUTROPHICATION FACTORS IN LAKE WEIR, FLORIDA

Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.  
P. O. Brezonik, and J. J. Messer.

In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 1-24, 6 fig, 9 tab, 30 ref.

Descriptors: \*Lake Weir(FL), \*Trophic level, \*Mesotrophy, \*Limnology, \*Eutrophication, \*Florida, Lakes, Phytoplankton, Chlorophyll, Algae, Nutrients, Nitrogen, Phosphorus, Primary productivity, Cyanophyta, Vollenweider models.

Present water quality of Lake Weir in central Florida is good and a mesotrophic classification is appropriate. Biological parameters in the lake reflect a diverse, moderately productive ecosystem exhibiting no nuisance conditions associated with excessive growth of macrophytes or algae. Two independently-derived trophic state indices bear out biological delineation of the mesotrophic status. Nitrogen and phosphorus concentrations indicate borderline eutrophic conditions, and there is evidence of a significant increase in phosphorus in the lake in recent years. Lake Weir has a low flushing rate making it sensitive to nutrient loading, and application of lake data to the Vollenweider input-output model shows that areal phosphorus loading rates are at the danger level. Lake Weir is a 2200-ha soft water lake located on the central Florida ridge; it has a watershed dominated by citrus groves, and it receives no permanent surface streams or wastewater influents. Chlorophyll analyses demonstrate that chlorophyll-a is the only important chlorophyll in the water column; phaeopigments

were rarely encountered except in surface samples. Mean chlorophyll-a concentration was 8.24 mg/cu m in 1974. Phytoplankton is dominated by Cyanophyta, especially *Oscillatoria submembranosa* and *Microcystis aeruginosa*. (See also W78-12895) (Lynch-Wisconsin) W78-12896

#### AN OVERVIEW OF LIMNOLOGICAL CHARACTERISTICS OF SHAGAWA LAKE, MINNESOTA

Corvallis Environmental Research Lab., OR.  
K. W. Malueg, D. W. Schults, and D. P. Larsen.  
In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 25-46, 11 fig, 4 tab, 13 ref.

Descriptors: \*Shagawa Lake(MN), \*Limnology, \*Eutrophication, \*Trophic level, \*Phosphorus, \*Waste water treatment, Tertiary treatment, Nitrogen, Phytoplankton, Algae, Cyanophyta, Chlorophyll, Lakes, \*Minnesota, Water pollution effects, Water pollution control.

Shagawa Lake, adjacent to Ely in northeastern Minnesota, is classified as eutrophic on the basis of measured limnological variables, a status extremely rare among the predominantly oligotrophic lakes in this region of Minnesota. The lake has received municipal wastewater effluents since 1901; primary treatment began in 1912, secondary treatment in 1954, and tertiary treatment for phosphorus removal in 1973. Most data used in this study was from 1972. During the past eight years the Environmental Protection Agency has intensively studied Shagawa Lake to evaluate lake restoration by wastewater phosphorus removal. Indications of eutrophic conditions during the summer include: (1) high pH in the epilimnion, (2) anaerobic conditions in the hypolimnion, (3) low Secchi disk values, and (4) large variations of nitrogen and phosphorus with time and depth. Summer phytoplankton are predominantly cyanophytes, and chlorophyll values reach about 60 micrograms/lite. Spring-time soluble reactive phosphorus and inorganic nitrogen levels are generally at or above critical bloom concentrations of 0.01 and 0.3 mg/l, respectively, as determined for 17 Wisconsin lakes. About 80% of the phosphorus and 27% of the nitrogen entering the lake are attributable to municipal wastewater. Initiation of tertiary treatment in 1973 reduced phosphorus loading by 80%, and the trophic condition is changing from eutrophy to mesotrophy. (See also W78-12895) (Lynch-Wisconsin) W78-12897

#### LAKE SALLIE, MINNESOTA

North Dakota Univ., Grand Forks. Dept. of Biology.  
J. K. Neel.

In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 47-63, 2 fig.

Descriptors: \*Limnology, \*Lake Sallie(MN), \*Eutrophication, \*Water pollution control, \*Sewage treatment, Waste water treatment, \*Minnesota, Lakes, Phytoplankton, Algae, Waste water disposal, Biochemical oxygen demand, Coliforms, Municipal wastes, Septic tanks, Water pollution effects, Trophic level, Effluents, Lake restoration, Harvesting, Agricultural runoff.

Lake Sallie, near the city of Detroit Lakes in western Minnesota, is late mesotrophic or early eutrophic. It is culturally enriched by wastewater effluents which have been discharged into the lake from Detroit Lakes for over 70 years, by drainage from 168 septic tanks, and by groundwater inflow from agricultural lands. Sewage treatment in recent years has been very effective for such parameters as biochemical oxygen demand and coliforms. Waste discharges have put in 7,000-20,000 kg phosphorus and 5,000-11,000 kg nitrogen per year; surface land runoff has contributed up to

474 kg phosphorus and 610 kg nitrogen; direct precipitation has added up to 18 kg phosphorus and 24 kg nitrogen; and groundwater inflow was supplied up to 1552 kg phosphorus and 8750 kg nitrogen annually. Thermal stratification usually comes and goes during summer and early fall, but has been known to endure continuously for about two months. When present the hypolimnion occupies a relatively small volume. Weed and fish harvest has not removed more than a fraction of annual nitrogen and phosphorus increments. Complete removal of the biota would eliminate only part of the annual phosphorus load, and significant removal of nutrients from inflowing water appears the only practicable method of lake restoration. Weed harvesting resulted in an increase in phytoplankton mass and photosynthesis. (See also W78-12895) (Lynch-Wisconsin) W78-12898

#### THREE OLIGOTROPHIC LAKES IN NORTHERN MINNESOTA

National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.

S. J. Tarapchak, and R. F. Wright.

In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 64-90, 1 fig, 13 tab, 14 ref.

Descriptors: \*Trophic level, \*Dogfish Lake(MN), \*Meander Lake(MN), \*Lamb Lake(MN), \*Forest fires, Water pollution effects, Watersheds(Basins), Lakes, Mesotrophy, Eutrophication, Water chemistry, Oligotrophy, Phytoplankton, Nutrients, Algae, Hydrology, Limnology, Model studies, Salinity, \*Minnesota, Vollenweider models.

Effects of a severe forest fire in May 1971 on the watersheds and water quality of two oligotrophic lakes in northeastern Minnesota—Meander Lake and Lamb Lake—were investigated. A third oligotrophic lake, Dogfish Lake, served as control. Analysis of water chemistry, phytoplankton, nutrient budgets, and hydrology showed that increased phosphorus export from the watersheds of Meander and Lamb Lakes were not high enough to change their classification from oligotrophic to mesotrophic as judged by Vollenweider's nutrient loading/trophic state model. The lands surrounding the lakes, on the Precambrian Shield, consist primarily of virgin deciduous-coniferous forest which has been largely undisturbed except for some timbering, and construction of a camp, trail, and dirt road. The May 1971 fire, which burned 5900 ha, destroyed 70% of the overstory in the Meander Lake watershed, and 65% in the Lamb Lake drainage basin. The three lakes are low in salinity, with concentrations and ionic proportions of major anions and cations similar to those reported for the Experimental Lakes Region in Ontario, Canada. On the basis of Vollenweider's trophic scale for northern temperate lakes, the annual average phytoplankton biomass would classify Dogfish and Meander Lakes as oligotrophic (1.5-5.0 mg/l), and Lamb Lake as eutrophic. Chlorophyll-a and total phosphorus levels would place Dogfish and Meander Lakes in either oligotrophic or mesotrophic categories, while Lamb Lake would again be categorized as eutrophic. (See also W78-12895) (Lynch-Wisconsin) W78-12899

#### PHYTOPLANKTON, PHOSPHORUS, AND SEWAGE EFFLUENTS IN LAKE MINNETONKA

Minnesota Univ., St. Paul. Dept. of Ecology and Behavioral Ecology.  
R. O. Megard.

In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 91-116, 7 fig, 7 tab, 21 ref.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**Descriptors:** \*Lake Minnetonka(MN), \*Phytoplankton, \*Phosphorus, \*Water pollution control, \*Photosynthesis, \*Trophic level, Sewage disposal, \*Minnesota, Lakes, Algae, Nutrients, Effluents, Municipal wastes, Water pollution effects, Diversion, Sediments, Limnology, Chlorophyll, Equations, Analytical techniques, Forecasting.

Diversion of sewage effluents away from Lake Minnetonka, near Minneapolis, Minnesota has significantly decreased phosphorus concentrations and phytoplankton densities. Construction of secondary sewage treatment plants in area villages was begun in 1927, and disposal of sewage into the lake resulted in a decline in water quality. Minimum Secchi disk transparency in Lower Lake Minnetonka (the largest basin) decreased from 2.5 m in 1937 to 0.9 m in 1969, and maximum phytoplankton densities increased fourfold. Effluents were diverted from the lower lake during 1971-72. Phosphorus was identified as the limiting factor for phytoplankton growth during the summers of 1968-69. After diversion annual phosphorus inputs decreased from 0.5 to 0.1 g/sq m, mean phosphorus concentration decreased from 48 mg/cu m during the summer of 1968 and 1969 to 34 mg/cu m during the summers of 1973 and 1974, and mean chlorophyll-a levels decreased from 37 mg/cu m to 17 mg/cu m at the rate of 1.0 mg Chl per mg of phosphorus decrease. Annual mean phosphorus concentration decreased from 62 mg/cu m in 1969 to 47 mg/cu m in 1973, or 50% of the decrease required to attain the steady state concentration predicted with a balance equation for phosphorus in a perfectly mixed basin. The trophic state before and after diversion is described objectively by changes in the relative integral photosynthetic rate. (See also W78-12895) (Lynch-Wisconsin)

W78-12900

#### REPORT ON THE MINNEAPOLIS CITY LAKES,

Minnesota Univ., Minneapolis. Limnological Research Center. J. Shapiro.

**In:** North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 117-134, 3 fig.

**Descriptors:** \*Minneapolis, \*Lakes, \*Storm runoff, \*Eutrophication, \*Water pollution effects, \*Biocontrol, Brownie Lake(MN), Cedar Lake(MN), Lake of the Isles(MN), Lake Calhoun(MN), Lake Harriet(MN), Water levels, Cooling water, Trophic level, \*Minnesota, Zooplankton, Grazing, Algae, Phytoplankton, Daphnia, Fish, Environmental control.

The five lakes composing the Minneapolis Chain of Lakes have become increasingly eutrophic in recent years due to attempts to alleviate chronic low water levels with water inputs from various sources. Brownie Lake, Cedar Lake, Lake of the Isles, and Lake Calhoun are connected by man-made channels, while southernmost Lake Harriet is isolated. The four upper lakes have had low water problems because of their connection with the groundwater table, which is too low to sustain them. Measures to augment water level have included: (1) storm drainage from Minneapolis directed into the lakes since 1912, (2) groundwater used by industry for cooling discharged to the four upper lakes, and (3) Mississippi River water and city drinking water pumped into the lakes during recent dry years. Storm drain inputs have been the major contributor to eutrophication. Summer chlorophyll levels, transparency, and algal abundance suggest that Lake of the Isles is becoming less eutrophic while Calhoun and Harriet Lakes are becoming more so. Whereas nutrient budgets apparently have not changed in recent years, transparency correlates well with Daphnia abundance, indicating that algal density is affected by zooplankton grazing, which in turn may be related to zooplanktivorous yellow perch

abundance. The possibility of using carnivorous fish to control zooplanktivorous fish is under investigation. By most criteria, the order of the lakes from most to least eutrophic is: Lake of the Isles, Brownie, Calhoun, Harriet, and Cedar. (See also W78-12895) (Lynch-Wisconsin)

W78-12901

#### A DESCRIPTION OF THE TROPHIC STATUS AND NUTRIENT LOADING FOR LAKE GEORGE, NEW YORK,

Rensselaer Polytechnic Inst., Troy, NY. Fresh Water Inst. J. J. Ferris, and N. L. Clesceri.

**In:** North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 135-181, 14 fig, 23 tab, 24 ref.

**Descriptors:** \*Lake George(NY), \*Trophic level, \*Oligotrophy, \*Nutrients, \*Phosphorus, Geologic history, \*New York, Model studies, CLEANX model, Lakes, Limnology, Sediments, Phytoplankton, Zooplankton, Algae, Floral lists, Macrophytes, Primary productivity, Succession.

Investigation of the geography, morphology, hydrology, limnology, and nutrient budgets of Lake George, New York, demonstrates that geologic history largely determined its present trophic status. Estimated phosphorus loading is 0.0684 gm/sq m/yr, and with a mean depth of 18 m and a mean retention time of eight years, the lake can be classified as oligotrophic. Even if the lake's two basins are measured separately an oligotrophic classification is warranted, despite the south basin having a shoreside human population four to six times that of the north basin, and having two sewage treatment plants within its watershed. The lake, lying in a long, narrow channel bordered by heights exceeding 600 m above the lake surface, has a ratio of drainage basin surface area to lake surface area of only 4.3. Only a thin soil cover overlies much of the basin, and fits Volenweider's oligotrophic soil category. Precipitation is the only form of hydrologic import. Simulation using the process model CLEANX shows a close fit between predicted and observed levels of zooplankton and phytoplankton biomass, and indicated that nutrient inputs from streams with subsequent internal recycling are the principal nonphysical driving forces in the Lake George ecosystem. High spring nutrient loadings result in a pulse of phytoplankton biomass, principally the net plankton *Asterionella formosa*; mean daily rises to 1.5 gm C/sq m/day or higher. Zooplankton predation (especially discuspidatus) follows. (See also W78-12895) (Lynch-Wisconsin)

W78-12902

#### THE LIMNOLOGY OF CAYUGA LAKE, NEW YORK—A SUMMARY,

Cornell Univ., Ithaca, NY. Dept. of Natural Resources. R. T. Oglesby.

**In:** North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 182-204, 3 fig, 6 tab, 57 ref.

**Descriptors:** \*Limnology, \*Cayuga Lake(NY), \*Trophic level, \*Mesotrophy, \*Eutrophication, \*New York, Lakes, Glaciation, Oligotrophy, Chlorophyll, Primary productivity, Industrial wastes, Nutrients, Phosphorus, Dissolved oxygen, Benthic fauna, Fish, Phytoplankton, Algae, Zooplankton, Bioassay, Nitrogen, Nitrates, Macrophytes.

Cayuga Lake, a moderately large and deep cold-water lake north of Ithaca, New York, affected by a variety of human influences, is representative of north temperate glacial lakes. Its relatively uncomplicated morphology—characterized by low shoreline development, restricted littoral zone (except at the tail end), and a single basin—make Cayuga Lake an excellent site for illustrating limnological principles. Most biotic and abiotic

descriptive properties categorize the lake as mesotrophic, although for certain parameters and at specific times a eutrophic or oligotrophic classification would be more appropriate. Dominant phytoplankton groupings are typical of both oligotrophic conditions (*Cyclotella*, *Tabellaria*, *Chrysomonads*, and *Sphaerocystis*) and eutrophic conditions (*Myxophyceae* and *Melosira*). The mesotrophic categorization is correlated by: (1) mean summer euphotic zone chlorophyll concentrations of 5-10 mg/cu m; (2) annual primary production rates of about 160 mg C/sq m/day; (3) minimum hypolimnetic dissolved oxygen concentration of about six mg/liter; (4) faunal composition, with fishes including both salmonids and carp; and (5) standing crop of profundal benthos (0.5-1.0 gm organic matter/sq m). Comparison of data from 1910-30 with data from 1950-74 indicates that productivity has increased. Making trophic state a function of total phosphorus loading vs mean depth, or vs mean depth to water residence time, indicates eutrophication, with total phosphorus loadings above the dangerous level. (See also W78-12895) (Lynch-Wisconsin)

W78-12903

#### TROPHIC STATUS AND NUTRIENT BALANCE FOR CANADARAGO LAKE,

New York State Dept. of Environmental Conservation, Albany. L. J. Hetling, G. W. Fuhs, and S. P. Allen.

**In:** North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 205-241, 12 fig, 20 tab, 38 ref.

**Descriptors:** \*Canadara Lake(NY), \*Trophic status, \*Eutrophication, \*Nutrients, \*Sewage disposal, \*Phosphorus, \*Waste water treatment, \*Tertiary treatment, Lakes, \*New York, Algae, Phytoplankton, Nutrient removal, Dissolved oxygen, Limnology, Stratification, Water pollution effects, Nitrogen, Cyanophyta.

Data gathered primarily from 1968-74 on limnological conditions in Canadara Lake (east-central New York) prior to initiation of tertiary sewage treatment in the village of Richfield Springs, indicate strongly eutrophic conditions. In this stratified lake of moderate size (759 ha), eutrophication appears to be caused by input of raw sewage from the village and from summer camps and cottage septic systems. Dense cyanophyte blooms are more severe than would be expected from the lake's morphometry (seven m mean depth), which would be more likely to produce moderate eutrophication. Construction of a modern tertiary treatment facility was completed in 1973, and by fall 1974 the lake showed clear signs of recovery. The new plant removes 93-94% BOD and up to 90% phosphorus, providing a maximum effluent concentration of 0.5 mg P/liter. The major emphasis of the study was to develop nutrient budgets and to relate them to the lake's trophic status. In 1969-70, 44.1% of phosphorus input came from the village sewage treatment plant which had not been operational for several years; 42.4% was due to the lake's four major tributaries, 9.4% from the ungauged portion of the watershed, 2.3% from lakeside dwellings, and 1.7% from direct precipitation on the lake surface. Net phosphorus accumulation for 1969-70 (one year) was 790 kg/yr, of which 68.9% of the soluble phosphorus came from the treatment plant. Phosphorus loading is calculated at 0.8 g/sq m/yr. (See also W78-12895) (Lynch-Wisconsin)

W78-12904

#### LIMNOLOGICAL AND GEOCHEMICAL CHARACTERISTICS OF THE TWIN LAKES WATERSHED, OHIO,

Kent State Univ., OH. Center for Urban Regionalism and Environmental Systems. G. D. Cooke, D. W. Waller, M. R. McComas, and R. T. Heath.

**In:** North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 242-270, 3 fig, 40 tab, 19 ref.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Effects Of Pollution—Group 5C

**Descriptors:** \*Twin Lakes(OH), \*Watersheds(Basins), \*Trophic level, \*Eutrophication, \*Mesotrophy, \*Limnology, Geochemistry, Macrophytes, Phytoplankton, Algae, Aluminum sulfate, Chemical precipitation, Aphanozomonon flos-aquae, Diatoms, Bioindicators, Stratification, Sewage disposal, Septic tanks, Diversion, Phosphorus, \*Ohio, Lakes.

The Twin Lakes (Ohio) Project was established in 1971 to measure the response of East and West Twin Lakes to septic tank sewage diversion in 1973. Monitoring data for 1972-74 are reported here. Both lakes are small, kettle-type, dimictic second-class lakes. According to changing plankton characteristics, East Twin Lake is early eutrophic and West Twin Lake is mesotrophic, but the trend since diversion is toward mesotrophy in both lakes. Also: (1) Oxygen deficits are lower than often found in eutrophic lakes (0.0223 mg O<sub>2</sub>/sq cm/day in West Twin Lake and 0.0300 in East Twin Lake in 1974). (2) While the cyanophyte Aphanozomonon flos-aquae now dominates the phytoplankton, diatoms constitute an increasing fraction. (3) Mean cell volume in 1972-74 was 1.05-5.86 microliters/liter in West Twin Lake, and 3.44-6.59 in East Twin Lake; Vollenweider has suggested 3-5 as the borderline between mesotrophy and eutrophication. (4) Mean summer photic zone chlorophyll-a is at the low end of Sakamoto's range of 5-140 mg Chl-a/cu m for eutrophic lakes. (5) Maximum net plankton community photosynthesis has dropped since diversion from 3400 mg C/sq m/day to 474 in East Twin Lake, and to 575 in West Twin Lake, which are in the range of borderline eutrophic lakes. However, if macrophytes are included in the analysis, the lakes must be classified eutrophic. (See also W78-12895) (Lynch-Wisconsin) W78-12905

**WALDO LAKE, OREGON,**  
Corvallis Environmental Research Lab., OR.  
C. F. Powers, W. D. Sanville, and F. S. Stay.  
In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 271-287, 1 fig, 8 tab, 10 ref.

**Descriptors:** \*Waldo Lake(OR), \*Limnology, \*Oligotrophy, \*Phosphorus, \*Trophic level, Recreation, \*Oregon, Lakes, Mountain lakes, Mountains, Stratification, Water chemistry, Nutrients, Nitrogen, Baseline studies, Model studies, Vollenweider models.

Waldo Lake, located near the summit of Oregon's Cascade Mountains, is ultraoligotrophic, ranking among the most pristine lakes of the world. Recent development of access roads and campground facilities prompted a study of the possible response of the lake to pressures of increased recreational use. Waldo Lake's position on the lower left portion of the diagram on Vollenweider's scale implies that a relatively small increase in phosphorus loading could strongly alter the trophic status. Several different estimating methods place phosphorus loading at 0.028 g/sq m/yr and nitrogen loading at 0.44 g/sq m/yr; the nitrogen/phosphorus loading ratio is 15.7. The lake has no permanent tributaries, and the hydrologic and nutrient budgets are not amenable to accurate measurement. The relative importance of phosphorus in the lake is uncertain because of the very low concentrations of all measured nutrients. Comparisons with two other well-known ultraoligotrophic lakes, Crater Lake and Lake Tahoe, show that Waldo Lake's specific conductance is 1-2 orders of magnitude lower, its total dissolved solids one order of magnitude lower, and primary productivity and phytoplankton abundance lower. No zooplankton have been found in the lake. The ratio of mean depth to retention time is 1.68. (See also W78-12895) (Lynch-Wisconsin) W78-12906

**LAKE WASHINGTON,**  
Washington Univ., Seattle. Dept. of Zoology.  
W. T. Edmondson.  
In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 288-300, 2 tab, 17 ref.

**Descriptors:** \*Lake Washington(WA), \*Limnology, \*Eutrophication, \*Nutrients, \*Water pollution control, \*Estuaries, Algae, Cyanophyta, Primary productivity, Trophic level, Zooplankton, Sewage disposal, Diversion, Water pollution effects, Benthic fauna, Phytoplankton, \*Washington.

Basic data for Lake Washington (Washington) on geography, limnology, and nutrient budget are given, primarily for the years 1957-76. In the 1890s Lake Washington was connected to Lake Union, and in 1916 a canal was opened between Lake Union and Puget Sound. In the 1940s and 1950s a transitory layer of very dilute seawater formed in the deepest parts of Lake Washington. The lake has characteristically had a spring diatom bloom dominated by *Stephanodiscus*, *Fragilaria*, *Melosira*, and *Asterionella*. In 1933 and 1950 the summer population was mostly a mixture of chlorophyte species and some flagellates. During the period of eutrophication this basic pattern had superimposed on it a dense population of cyanophytes in the summer, including *Oscillatoria rubescens*, *O. agardhii*, *Microcystis*, *Anabaena*, and *Aphanozomonon*. Most abundant zooplankton are *Diatomus ashlandi*, *Epischura lacustris*, *Cyclops*, *Diaphanosoma leuchtenbergianum*, *Bosmina longirostris*, and the rotifers *Keratella cochlearis* and *Kellicottia longispina*. Bottom fauna is dominated by chironomids, with lesser numbers of tubificids and small mollusks (*Psidium*). Maximum input of treated secondary effluent was in 1962, and in March 1963 diversion was begun. Sewage was decreased from about 76,000 cu m per day (20 million gal); the project was completed in 1968. Nutrient inputs have varied greatly with the increase in sewage, and then with diversion. Data are presented by year on nutrient income and loading. (See also W78-12895) (Lynch-Wisconsin) W78-12907

**NUTRIENT LOADING AND TROPHIC STATE OF LAKE SAMMAMISH, WASHINGTON,**  
Washington Univ., Seattle. Dept. of Civil Engineering.  
E. B. Welch, T. Wiederholm, D. E. Spyridakis, and C. A. Rock.

In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 301-320, 3 fig, 4 tab, 15 ref. EPA R-800512; NSF GB-36810X.

**Descriptors:** \*Lake Sammamish(WA), \*Nutrients, \*Mesotrophy, \*Water pollution control, \*Trophic level, \*Eutrophication, Limnology, Lakes, Sewage disposal, Iron, Sediment-water interfaces, Stratification, Primary productivity, Phytoplankton, Algae, Phosphorus.

Lake Sammamish, Washington maintains its mesotrophic status, despite eutrophic levels of nutrient loading, through an internal iron-controlled sediment-water interchange mechanism which regulates incoming phosphorus available to phytoplankton. Total iron correlates closely with total phosphorus as oxygen is exhausted in the hypolimnion during August-October; the oxygen deficit rate is consistently high, about 0.05 mg/sq cm/day. Although phosphorus increases in surface waters following lake turnover in late November, phosphorus is rapidly complexed—probably by ferric hydroxides. Much of the released phosphorus is thereby resedimented and rendered unavailable to the phytoplankton when light is adequate in April and May. Lake Sammamish has been mesotrophic for over 100 years, according to sediment core analysis. The lake has been continu-

ously monitored since 1969. Because of early signs of eutrophication, secondary effluent from the town of Issaquah and dairy processing wastes were diverted in 1968, amounting to one-third of the lake's phosphorus loading. The internal control mechanism can resist phosphorus loading changes over a range of at least 0.66-1.0 g P/sq m/yr; stability is not likely to persist over a much greater range. Maximum total phosphorus is at overturn, reaching 40 micrograms/l (which, before diversion, exceeded 100). Total phosphorus loading is 0.66 g/sq m/yr and total nitrogen is 13 g/sq m/yr. Phytoplankton biomass, primary productivity, and benthic communities all indicate mesotrophy. (See also W78-12895) (Lynch-Wisconsin) W78-12908

**LAKE MENDOTA - NUTRIENT LOADS AND BIOLOGICAL RESPONSE,**  
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.  
J. M. Lopez, and G. F. Lee.  
In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 321-332, 2 fig, 9 tab, 22 ref.

**Descriptors:** \*Lake Mendota(WI), \*Eutrophication, \*Nutrients, \*Phosphorus, \*Water pollution control, \*Wisconsin, Lakes, Madison(WI), Trophic level, Limnology, Agricultural runoff, Urban runoff, Algae, Phytoplankton, Aquatic weed control, Oxygen depletion, Stratification, Water pollution effects, Nitrogen, Chlorophyll, Urbanization, Cyanophyta.

Nutrient loading data and other parameters for eutrophic Lake Mendota, Madison, Wisconsin show that, even with a five-fold reduction of phosphorus loadings, a dangerous level would persist. Increased urbanization in the watershed coupled with runoff from dairy farming operations make it likely that water quality will continue to deteriorate, with increased frequency of severe summer blue-green algal blooms and excessive growth of attached algae and macrophytes in the littoral zone. Control efforts should be directed at reduction of phosphorus inputs from agricultural drainage (especially animal manure) and urban storm drainage. While combined use of alum to precipitate phosphorus, herbicides, and mechanical weed harvesting would result in significant improvement, local public opposition makes use of chemicals unlikely. Hypolimnetic waters in Lake Mendota become devoid of oxygen during summer stratification, and after fall reoxygenation oxygen depletion again occurs in bottom waters during late winter. Algal populations include bloom-forming *Microcystis*, *Oscillatoria*, and *Lyngbya*, and the acetyle-reducing genera *Anabaena*, *Aphanozomonon*, *Nostoc*, *Calothrix*, and *Gloeotrichia*. Summer blue-green counts are typically one million cells/liter, and total chlorophyll averages 5000 kg during the summer. Current phosphorus loading (1.2 g/sq m/yr) is about 10 times Vollenweider's permissible level. (See also W78-12895) (Lynch-Wisconsin) W78-12909

**REPORT ON NUTRIENT LOAD - EUTROPHICATION RESPONSE OF LAKE WINGRA, WISCONSIN,**  
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.  
W. Rast, and G. F. Lee.  
In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 337-372, 9 fig, 11 tab, 28 ref.

**Descriptors:** \*Lake Wingra(WI), Madison(WI), \*Eutrophication, \*Nutrients, \*Phosphorus, \*Limnology, \*Water pollution control, Lakes, Trophic level, Algae, Phytoplankton, Myriophyllum spicatum, Eurasian water milfoil, Water pollution effects, Watersheds(Basins), Aquatic weed control, Nitrogen, Urban runoff, Vollenweider models, Wisconsin.



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

Eutrophic Lake Wingra in Madison, Wisconsin receives over 80% of its total phosphorus (980 kg/yr) and 90% of dissolved reactive phosphorus (570 kg/yr) from urban runoff. Very little dissolved reactive phosphorus enters the lake between storms; precipitation, dry fallout, and springflow contribute almost equal amounts (25, 21, and 30 kg/yr respectively). The Vollenweider loading curve values are 0.88 g/sq m/yr for phosphorus loading and 5.5 m/yr for mean depth/hydraulic residence time. The lake's eutrophic status as determined by these values is consistent with the physical, chemical, and biological characteristics of the lake. It is a shallow lake without a thermocline, the hypolimnion volume is low or absent, and transparency is low. Wind-generated mixing promotes nutrient cycling and a high degree of eutrophication. Blue-green algae usually dominate during summer. About one-third of total drainage comes from the University of Wisconsin Arboretum, and two-thirds is urban runoff. Reduction of phosphorus from urban runoff, such as through better street cleaning, would significantly reduce nutrient loadings to the lake. Total elimination of phosphorus input from urban runoff, although unlikely, would lower annual phosphorus loading to 0.23 g/sq m/yr and place Lake Wingra in the oligotrophic category. This article includes information on geography, hydrology, morphology, water chemistry, biota, and nutrient budgets. (See also W78-12895) (Lynch-Wisconsin) W78-12910

#### REPORT ON NUTRIENT LOAD - EUTROPHICATION RESPONSE OF SELECTED SOUTH-CENTRAL WISCONSIN IMPOUNDMENTS, Texas Univ. at Dallas, Richardson. Inst. for Environmental Studies.

M. D. Piwoni, and G. F. Lee.

In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 373-401, 2 fig, 17 tab, 21 ref.

Descriptors: \*Eutrophication, \*Trophic level, \*Water quality indices, \*Nutrients, \*Impoundments, \*Wisconsin, Lakes, Recreation, Phosphorus, Land use, Runoff, Water pollution sources, Algae, Cyanophyta, Macrophytes, Lake Redstone(WI), Dutch Hollow Lake(WI), Lake Virginia(WI), Lake Camelot(WI), Sherwood(WI), Lake Blackhawk(WI), Lake Stewart(WI), Cox Hollow Lake(WI), Twin Valley Lake(WI), Vollenweider models.

All of ten recreational impoundments assessed in central and southern Wisconsin were moderately to highly eutrophic, according to an eight-parameter trophic index. Nutrient loadings were estimated, and a comparison between nutrient load and trophic status was made through application of Vollenweider's logarithmic plot relating phosphorus loading to mean depth/hydraulic residence time. All ten impoundments were plotted in the region of the graph designated as eutrophic. The impoundments included six lakes created to improve real estate values—Lake Redstone, Virginia, Camelot North and South, and Sherwood, and Dutch Hollow Lake—and four public recreation lakes—Blackhawk, Stewart, Cox Hollow, and Twin Valley. Trophic state index parameters were Secchi depth, chlorophyll-a, dissolved oxygen depletion, winter and summer orthophosphate, winter and summer total phosphorus, and organic nitrogen. The index was modified from Lueschow, et al, 1970. All the impoundments suffer from excessive macrophyte growth in littoral areas, to greater or lesser degrees. Cyanophyte algae were dominant in all impoundments on at least two occasions during the summers of 1971 and 1972. From least to most eutrophic, with trophic state index, the lakes are: Camelot North (11), Sherwood (18), Camelot South (26), Redstone (41), Stewart (45), Blackhawk and Twin Valley (53), Cox Hollow (54), Virginia (55), and Dutch Hollow (67). (See also W78-12895) (Lynch-Wisconsin) W78-12911

**THE JOHN H. KERR RESERVOIR, VIRGINIA - NORTH CAROLINA,** North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering. C. M. Weiss, and J. H. Moore. In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 426-464, 2 fig, 25 tab, 5 ref.

Descriptors: \*John H. Kerr Reservoir(VA NC), \*Limnology, \*Trophic level, \*Nutrients, \*Vollenweider models, \*Reservoirs, \*Virginia, \*North Carolina, Multiple-purpose reservoirs, Stratification, Data collections, Nitrogen, Phosphorus, Hydraulic residence time, Flushing rate, Municipal wastes, Industrial wastes, Water pollution effects, Impoundments.

The 48,000-acre John H. Kerr Reservoir in Virginia and North Carolina receives substantial nitrogen and phosphorus loading from upstream municipal and industrial wastewater discharges. As the flow into the Roanoke arm is 80-90 times greater than into the Nutbush arm, residence time of the former is much shorter (60 days) than the latter (1800 days). Nutrient budgets for April 1974-March 1975 show that about 50% of phosphorus and 16% of nitrogen were retained in the impoundment. The validity of areal loading and total phosphorus as predictive dimensions (Vollenweider models) when retention time is high was verified by examination of phosphorus budget parameters and the response of the systems of each arm divided into five segments. Several variables describing conditions for algal growth were compared to growth as determined by chlorophyll-a and productivity; consistent high correlations of the Nutbush arm as compared to the low correlations or noncorrelations of the Roanoke arm indicate the systems' dependence on flushing rate to establish growth-limiting conditions. Analysis of secondary productivity, total zooplankton numbers, and algal cell density shows a correlation or value of -340 in the Roanoke arm, compared with .871 in the Nutbush arm. Impoundments with high phosphorus retention coefficients can remove considerable phosphorus, and even in those with comparatively short residence time, such as the Roanoke arm, considerable phosphorus may be removed by absorption onto iron-rich sediments. (See also W78-12895) (Lynch-Wisconsin) W78-12912

#### TROPHIC STATUS AND NUTRIENT LOADING FOR LAKE TAHOE, CALIFORNIA - NEVADA,

California Univ., Davis. Div. of Environmental Studies.

C. R. Goldman.

In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 463-480, 3 fig, 2 tab, 10 ref.

Descriptors: \*Lake Tahoe(CA NV), \*Trophic level, \*Nutrients, \*Oligotrophy, \*Limnology, \*Primary productivity, Phytoplankton, Algae, Eutrophication, Nitrogen, Phosphorus, \*California, \*Nevada, Lakes, Sewage disposal, Diversion, Sediments, Limiting factors, Nutrient flux.

Lake Tahoe in California and Nevada, a subalpine, ultraoligotrophic lake with record Secchi readings to 40 meters, has in recent years been subjected to increased nutrient inputs resulting from resident and tourist population growth and basin development. Because of its relatively small watershed and great volume, Lake Tahoe is at the extreme lower end of classifications based on loading; probably for the same reasons it is very sensitive to nutrient loading, as seen in data on primary productivity for 1959-74. By 1962 even treated sewage discharge was found to greatly stimulate phytoplankton primary productivity in the nutrient-poor water. Productivity apparently stopped increasing by 1974 in response to extensive sewage diversion, mostly completed by 1970. Daphnia and Bosmina are no longer dominant

zooplankters, and ultraplankton have increased at the lower end of the euphotic zone. Oxygen shows no measurable depletion, even at depths of 500 meters, and the dilute rain of organic matter into the abyssal zone is almost completely mineralized before it reaches the sediment. At present nitrogen levels the lake is rather insensitive to phosphorus and is an excellent example of a nitrogen-limited system. The lake appears highly sensitive to nitrogen loading, which has caused an increase in primary productivity of about 5%/year. Total phosphorus loading is about 0.047 g/sq m/yr, and nitrogen is 0.5156 g/sq m/yr (1969). (See also W78-12895) (Lynch-Wisconsin) W78-12913

#### REPORT ON NUTRIENT LOAD - EUTROPHICATION RESPONSE FOR THE OPEN WATERS OF LAKE MICHIGAN,

Texas Univ. at Dallas, Richardson, Center for Environmental Studies.

M. D. Piwoni, W. Rast, Jr., and G. F. Lee.

In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 481-498, 1 fig, 5 tab, 18 ref.

Descriptors: \*Lake Michigan, \*Nutrient removal, \*Phosphorus, \*Trophic level, \*Sewage treatment, \*Pelagic zone, Great Lakes, Lakes, Oligotrophy, Mesotrophy, Vollenweider models, Hydraulic residence time, Phytoplankton, Algae, Nearshore zone, Limiting factors.

Effects of reductions of effluent phosphorus into Lake Michigan on loading and quality of open waters are assessed. Bordering states adopted regulations in 1968 aimed at 80% reduction of phosphorus input from waste treatment plants by December 1972. Reductions should result in a small improvement in water quality of open waters in several years, manifested in reduced phytoplankton growth. The greatest improvement will probably occur in nearshore waters where phosphorus is or can be made the factor limiting planktonic and attached algal growth. In areas of restricted circulation, such as southern Green Bay, there will be little or no improvement in water quality, as 80% phosphorus removal would be insufficient to make phosphorus the limiting element for algal growth. This paper considers phosphorus loading estimates, problems in estimating nutrient loads and hydraulic residence time, and productivity. Estimated total phosphorus loading to the lake decreased from 18.1 million lbs/yr in 1971 to 12.4 million lbs/yr in 1974, reflecting improved treatment plant phosphorus removal. Use of the Vollenweider plot of phosphorus loading as a function of mean depth/hydraulic residence time places Lake Michigan open waters at the oligotrophic-mesotrophic boundary in 1971 and in the oligotrophic zone in 1974. Nearshore waters were mesotrophic in 1971 and oligotrophic-mesotrophic in 1974. (See also W78-12895) (Lynch-Wisconsin) W78-12914

#### TROPHIC STATUS AND NUTRIENT LOADING FOR LAKE MICHIGAN,

Michigan Univ., Ann Arbor. Great Lakes Research Div.

C. L. Schelske.

In: North American Project—A Study of U.S. Water Bodies; Publication No. EPA-600/3-77-086, July 1977. p 499-536, 5 fig, 6 tab, 64 ref.

Descriptors: \*Lake Michigan, \*Indicators, \*Trophic level, \*Phytoplankton, \*Nutrients, \*Silica, Environmental effects, Water pollution effects, Phosphorus, Bioindicators, Great Lakes, Lakes, Limnology, Algae, Limiting factors, Eutrophication, Chlorophyll, Primary productivity, Zooplankton, Benthic fauna, Fish, Species composition, Ecosystems, Nitrates.

Effects of nutrient loading on the biochemistry of Lake Michigan are assessed, and current and past

trophic conditions are described. Phosphorus limits phytoplankton growth and primary production in the lake, as is the case in Lakes Superior and Huron. Of Lake Michigan biota, only phytoplankton can be used to monitor changes in trophic state. Due to the relative insensitivity of phytoplankton biomass or chlorophyll-a concentration as indicators in Lake Michigan, however, it is proposed that silica and nitrate depletion in the euphotic zone during summer stratification be used as trophic state indicators. The benthic community has not shown significant qualitative changes from nutrient enrichment, and quantitative changes in standing crop must be large to be detectable. Zooplankton data are inadequate for long-term assessments of standing crop. Variations in fish abundance and species composition have not been correlated with trophic status. On the other hand, changes in phytoplankton species composition apparently reflect nutrient enrichment, and the replacement of diatoms by cyanophytes as dominant phytoplankters corresponds to silica depletion in the euphotic zone during summer. The most serious changes in the lake have occurred relatively recently (in the last 20 years). Modelling indicates a considerable delay between the beginning of phosphorus loading (which began probably in the 1940s) and effects on the benthic system. (See also W78-12895) (Lynch-Wisconsin)

W78-12915

#### PROCEEDINGS OF THE 3RD AQUATIC TOXICITY WORKSHOP HELD IN HALIFAX, NOVA SCOTIA, NOVEMBER 2-3, 1976.

Environmental Protection Service, Halifax (Nova Scotia).  
For primary bibliographic entry see Field 5A.  
W78-12952

#### CHEMISTRY IN THE DETERMINATION OF TOXICITY OF CHEMICALS TO AQUATIC FAUNA.

Fisheries and Marine Service, St. Andrews (New Brunswick).  
For primary bibliographic entry see Field 5A.  
W78-12956

#### A DISCUSSION ON THE USE OF BEHAVIOR BY GAMMARUS PSEUDOLIMNAEUS BOUSFIELD IN EVALUATING ENVIRONMENTAL STRESS.

Fisheries and Marine Service, Halifax (Nova Scotia).  
For primary bibliographic entry see Field 5A.  
W78-12958

#### A FIELD TECHNIQUE FOR STUDYING THE AVOIDANCE OF FISH TO POLLUTANTS.

Fisheries and Marine Service, Vancouver (British Columbia). Habitat Protection Directorate.  
For primary bibliographic entry see Field 5A.  
W78-12959

#### ASSESSMENT OF THE TOXICITY OF LANDFILL LEACHATES BY THE RESIDUAL OXYGEN BIOASSAY.

EVS Consultants Ltd., New Westminster (British Columbia).  
For primary bibliographic entry see Field 5A.  
W78-12960

#### AN EVALUATION OF DEATH BY HYPOXIA IN A MARINE FISH AS AN INDICATOR OF OIL DEPRESSANT TOXICITY.

Fisheries and Marine Service, St. John's (Newfoundland).  
For primary bibliographic entry see Field 5A.  
W78-12962

#### APPLICATION OF TISSUE CULTURE SYSTEMS TO EVALUATE AQUATIC TOXICANTS.

Fisheries and Marine Service, Halifax (Nova Scotia). Halifax Lab.  
For primary bibliographic entry see Field 5A.  
W78-12964

#### COMPARISON OF RAPID BIOASSAY PROCEDURES FOR MEASURING TOXIC EFFECTS OF BLEACHED KRAFT MILL EFFLUENT TO FISH.

British Columbia Research Council, Vancouver. Div. of Applied Biology.  
For primary bibliographic entry see Field 5A.  
W78-12965

#### PRESENT APPROACHES TO TOXICITY TESTING - A PERSPECTIVE.

Environmental Research Lab.-Duluth, MN.  
For primary bibliographic entry see Field 5A.  
W78-12967

#### A MECHANICAL TOXICANT INJECTOR FOR FLOW-THROUGH TOXICITY TESTS.

Lakehead Univ., Thunder Bay (Ontario). Dept. of Biology.  
For primary bibliographic entry see Field 5A.  
W78-12971

#### METHOD FOR ASSESSING ADDITIVE TOXICITY OF CHEMICAL MIXTURES.

Fish and Wildlife Service, LaCrosse, WI. Fish Control Lab.  
For primary bibliographic entry see Field 5A.  
W78-12973

#### BIOASSAYS WITH A NATURAL ASSEMBLAGE OF BENTHIC MACROINVERTEBRATES.

Oklahoma State Univ., Stillwater. School of Biological Sciences.  
For primary bibliographic entry see Field 5A.  
W78-12976

#### UTILITY OF TOXICITY TESTS WITH EMBRYOS AND FRY OF FISH IN EVALUATING HAZARDS ASSOCIATED WITH THE CHRONIC TOXICITY OF CHEMICALS TO FISHES.

EG and G, Bionomics, Wareham, MA.  
For primary bibliographic entry see Field 5A.  
W78-12977

#### UPTAKE, CLEARANCE, AND BIOCONCENTRATION OF 14C-SEC-BUTYL-4-CHLORODIPHENYL OXIDE IN RAINBOW TROUT.

Dow Chemical Co., Midland, MI.  
For primary bibliographic entry see Field 5A.  
W78-12979

#### AN EVALUATION OF FENITROTHION TOXICITY IN FOUR LIFE STAGES OF RAINBOW TROUT, SALMO GAIRDNERI.

Fisheries and Marine Service, Winnipeg (Manitoba).  
J. F. Klaverkamp, M. Duangsawadsi, W. A. MacDonald, and H. S. Majewski.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 231-240, 1977. 4 fig, 1 tab, 37 ref.

Descriptors: \*Pesticide toxicity, \*Rainbow trout, \*Insecticides, \*Toxicity, Organic pesticides, Organic compounds, Water pollution effects, Environmental effects, Fish physiology, Growth stages, Embryonic growth stage, Fry, Mortality, Enzymes, Biochemistry, Animal metabolism, Fish behavior, \*Fenitrothion.

Lethal and sublethal effects of fenitrothion, an organophosphate insecticide, were investigated in rainbow trout embryos, sac fry, fingerlings, and adults. Based on acute mortality tests, the embryological life stage was the least sensitive, the sac fry was intermediate, and the life stages of fingerlings and adults were the most sensitive. The sublethal responses, cholinesterase inhibition in fingerling and the cough response in adult trout, were sensitive to 0.75 and 0.5 mg/liter fenitrothion. (See also W78-06608) (EIS-Deal)  
W78-12983

#### ACUTE TOXICITY TO AND BIOCONCENTRATION OF ENDOSULFAN BY ESTUARINE ANIMALS.

Environmental Research Lab., Gulf Breeze, FL. S. C. Schimmel, J. M. Patrick, Jr., and A. J. Wilson, Jr.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 241-252, 1977. 3 tab, 23 ref.

Descriptors: \*Pesticide toxicity, \*Pink shrimp, \*Mullet, \*Insecticides, \*Toxicity, Chlorinated hydrocarbon pesticides, Shrimp, Path of pollutants, Water pollution effects, Organic compounds, Environmental effects, Animal metabolism, Animal physiology, Fish physiology, Estuarine environment, \*Toxicity testing, \*Bioconcentration, \*Endosulfan, \*Tissue analysis, \*Pinfish.

Acute 96-h flow-through toxicity tests with endosulfan (Thiodan) were conducted with several estuarine animals. The test species were: pink shrimp, grass shrimp, pinfish, spot, and striped mullet. Our studies suggest that endosulfan in the estuarine environment would be a hazard because of its acute toxicity and bioconcentration potential, but animals surviving exposure and moving to areas free of endosulfan would lose the chemical rapidly. (See also W78-06608) (EIS-Deal)  
W78-12984

#### THE EFFECT OF SUBACUTE PARATHION EXPOSURE ON THE LOCOMOTOR BEHAVIOR OF THE BLUEGILL SUNFISH AND LARGEMOUTH BASS.

Raytheon Co., Portsmouth, RI. Oceanographic and Environmental Dept.  
G. M. Rand.  
In: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F.L. Mayer and J.L. Hamelink, eds., American Society for Testing and Materials, p 253-268, 1977. 8 fig, 5 tab, 27 ref.

Descriptors: \*Pesticide toxicity, \*Sunfishes, \*Bass, Bioassay, Water pollution effects, Environmental effects, Fish behavior, Fish physiology, Animal metabolism, Chemical properties, Organophosphorus pesticides, Insecticide, Pesticide kinetics, \*Parathion, \*Toxicity testing.

The effects were studied of a 24-h exposure to a subacute concentration of parathion on the locomotor orientation of the bluegill sunfish and largemouth bass in response to a food odor in water and water without odor. In sunfish, prior to parathion exposure, odor/Flow II was more attractive than any other condition. Following exposure, the response to Flow II and to odor/Flow II was avoidance, that to odor/Flow I remained attractive, thus causing a parathion by flow interaction. Two weeks after exposure, the relative response to the treatments was similar to that of unexposed fish. In bass, prior to parathion exposure, the odor/Flow II was also more attractive than any other condition but the fish were unable to discriminate between odor/Flow I and Flow I alone. Following exposure, the fish were unable to discriminate between odor/Flow I and Flow I alone. Flow I (the control), whereas particularly odor/Flow I and, to a lesser extent, Flow II were avoided. Thus, there was a significant interaction

### Group 5C—Effects Of Pollution



## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

Fish management, Animal pathology, Cytological studies, Mortality, Water temperature, Aquaculture, \*Furanace.

Cold-water disease (CWD) is an acute septicemic infection of young coho salmon. The purpose of this study was to test the efficacy of Furanace to control CWD. The results obtained in this investigation demonstrate that Furanace can be effectively administered merely by adding the chemotherapeutic to water containing the fish. Because CWD may become severe in sac-fry, which do not take medicated feed, this treatment procedure could be very valuable. (EIS-Deal) W78-12997

**THE EFFECTS OF PHENYLMERCURIC ACETATE ON THE GROWTH OF CHLAMYDOMONAS VARIABILIS DANG,** Paris-11 Univ., Orsay (France). Lab. de Cryptogamie et de Biologie Cellulaire. A. Delcourt, and J. C. Mestre. Bulletin of Environmental Contamination and Toxicology, Vol. 20, p 145-148, 1978. 3 fig, 5 ref.

Descriptors: \*Mercury, \*Toxicity, \*Growth rates, \*Chlamydomonas, Water analysis, Aquatic populations, Aquatic algae, Water pollution effects, Phytoplankton, Cytological studies, Chemical properties, Biological membranes, Membrane processes, \*Phenylmercuric acetate.

Two characteristics of the toxic action of phenylmercuric acetate on the growth of *C. variabilis* were determined. The existence of a threshold concentration below which there was no toxicity evident was revealed. The threshold dose was proportional to the algal cell concentration. A lag phase, which was the first preceptible sign of toxicity was also noted. The duration of the lag phase increased with decreasing initial algal cell concentration and also increased with increasing concentrations of phenylmercuric acetate. (EIS-Deal) W78-12998

### 5D. Waste Treatment Processes

**MANAGEMENT OF SWINE MANURE FOR THE RECOVERY OF PROTEIN AND BIOGAS,** Oregon State Univ., Corvallis. Dept. of Soil Science. L. Boersma, E. Gasper, J. Miner, J. Oldfield, and H. Phinney. Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 722. Price codes: A14 in paper copy, A01 in microfiche. Agricultural Experiment Station Special Report No. 507, May, 1978. 264 p. OWRT B-044-ORE(3).

Descriptors: Water reuse, Energy recovery, \*Waste treatment, \*Protein recovery, Management, \*Farm wastes, \*Biogas recovery, Nutrients, Gases, Biodegradation, Algae, Bacteria, Biological treatment.

Major findings of an investigation into the concept of nutrient and energy recovery from a swine waste management system are reported. Algae and bacteria were used to convert swine manure into methane-rich fuel gas and supplemental protein for animal feed. Waste heat from electricity generating plants was simulated to test its value in enhancing the biological recovery of nutrients and energy. The experimental facility was built adjacent to the Swine Research Center at Oregon State University and consisted of animal quarters with solid concrete floor and gutter to house 50 pigs, an anaerobic digester with a volume of 14 m<sup>3</sup>, and 12 outdoor algae basins with a combined surface area of 24 m<sup>2</sup> and a combined volume of 6,000 l. Manure was removed from the animal quarters by a gutter flushing system. The solids were separated from the liquids by gravity settling and then pumped into the digester for solubilization and recovery of biogas. The liquid phase of

the diluted manure was pumped into the outdoor basins to serve as nutrient substrate for the growth of the high temperature strain 211/8K of *Chlorella vulgaris* as the predominant algal species. The algal biomass was concentrated by centrifugation and freeze dried. Its nutritional value as a protein source was determined by feeding trials with Long-Evans rats. W78-12108

**CONTROL OF ACTIVATED SLUDGE TREATMENT,** Delaware Univ., Newark. Dept. of Chemical Engineering. M. M. Dean. Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 068. Price codes: A02 in paper copy, A01 in microfiche. Completion Report, October 1977. 17 p. OWRT A-033-DEL(1), 14-34-0001-7016.

Descriptors: \*Activated sludge, Control systems, Mathematical models, \*Sewage treatment, \*Sludge treatment, Waste water treatment.

The activated sludge process for wastewater treatment consists of a biochemical reactor followed by a settler, with recycle of sludge from the settler to the reactor. The process is subject to large influent variations over a twenty-four hour cycle. Published dynamic simulations of continuous sedimentation assume that only discrete layers of constant concentration can exist. This assumption is not valid for all changes in feed concentration and underflow rate. A dynamic simulation model was developed which accounts for the possible regions of continuous concentration variation. Simulations show that the dynamics of the activated sludge process are governed under certain conditions by interactions between the reactor and the settler through sludge recycle. Settler underloading can lead to extremely sluggish recycle. Settler underloading can lead to extremely sluggish system response, indicating that effective sludge height regulation is an important control objective. This objective may be in conflict with the need to maintain small variations in reactor solids concentration. An effective compromise can be achieved by using ratio control on both sludge recycle and settler underflow. This control policy does not require sludge storage. W78-12117

**SEWAGE BIOCHEMICAL PURIFICATION APPTS. - HAS MAIN TANK FILLED WITH PERFORATED PLASTIC FILM ON WHICH THE BIOMASS FORMS.** Soviet Patent SU-567-675. Issued August 26, 1977. Derwent Soviet Inventions Illustrated, Vol. A. No. 24, p 10-11, July, 1978. 1 fig.

Descriptors: \*Biological treatment, \*Semipermeable membranes, \*Spraying, \*Plastics, \*Patents, Biological membranes, Storage tanks, Pumps, Biomass, Biodegradation, Waste water treatment, Municipal wastes.

A patented biochemical waste water treatment system supports an excess of biomass on a perforated plastic film mounted on vertical screens. Raw waste water flows through a pipe into a storage tank containing recirculated effluent. The mixed liquor is pumped into the treatment tank through a pipe terminating in a sprinkler distribution system. As the waste water flows down through the perforated plastic film, it becomes saturated with air. The air-saturated effluent and biomass collect in a chamber below the vertical screens for further treatment. Treated effluent collects in channels located around the periphery of the treatment tank; it is allowed to settle before it is drawn off through another pipe. Unoxidized biomass and a portion of the effluent are returned to the storage tank for mixing with raw influent. (Lisk-FIRL) W78-12120

**CLEANING RAKE ARRANGEMENT FOR A DRAIN CHANNEL GRID - IS OF LOW, STABLE CONSTRUCTION AND SUITABLE FOR GRIDS WITH STRAIGHT BARS.** For primary bibliographic entry see Field 8G. W78-12121

**FLOCCULATING AND DRAINAGE SLUDGE FROM EFFLUENT PURIFICATION PLANT - IN LOW COST LOW ENERGY POTENTIALLY MOBILE FILTER PLANT.** French Patent FR 2363-524. Issued May 5, 1978. Derwent French Patents Abstracts, Vol. A, No. 22, p 4, July, 1978.

Descriptors: \*Flocculation, \*Filtration, \*Sludge treatment, \*Dewatering, \*Patents, Design data, Equipment, Filters, Deflection, Sewage sludge, Sludge disposal, Waste water treatment, Municipal wastes.

A rotating drum apparatus flocculates and filters sewage sludge, producing a homogeneous, dewatered product. The sewage sludge is flocculated in a rotating drum with a central inlet and outlet. Surrounding the flocculation drum and sharing the same axis is a counter-rotating filter drum. As the inner drum rotates, filtrate passes through perforations in the drum wall and is distributed laterally by a series of paddles and deflectors attached to the drum walls. The filter drum contains a continuous filter band pressed against the drum's periphery by an outer driving filter band; successive filter band configurations are zig-zagged between pressure rollers. The system is amenable to packaged, mobile operation at several sites and provides simple operation with minimum maintenance and supervision. (Lisk-FIRL) W78-12140

**SEPARATOR OF ACTIVE SLUDGE FROM TREATED EFFLUENT - HAS FILTERING ELEMENTS WITH POSITIVE CONALITY SET VERTICALLY DIRECTLY ABOVE DISTRIBUTOR.** Soviet Patent SU-565-885. Issued July 21, 1977. Derwent Soviet Inventions Illustrated, Vol. A, No. 23, p 4, July, 1978. 1 fig.

Descriptors: \*Separation techniques, \*Activated sludge, \*Filtration, \*Distribution systems, \*Patents, Bubbles, Aeration, Sludge treatment, Cleaning, Equipment, Design data, Waste water treatment, Municipal wastes.

An aeration and filtration system to separate activated sludge from treated effluent has been patented. The separation unit consists of a reservoir tank containing vertical filter elements located above a water-air distribution system. Influent is introduced along a pipeline at the tank base into the distributor, along with previously treated effluent bearing dissolved air at 3-4 atmospheres. The waste water is evenly distributed over the bottom of the reservoir tank and passed upwards through filter elements which have positive slopes in the range of 1:20-25. As the effluent rises, suspended particles are entrapped in air bubbles and compacted on the filters. Concentrated sludge is scraped from the filters and discharged through a trough. Treated effluent is removed through an annular outlet for partial recirculation with influent. The surfaces of the filter elements are continuously regenerated by the upward movement of the air bubbles. (Lisk-FIRL) W78-12153

**TRAVELLING SLUDGE SCRAPER BRIDGE FOR EFFLUENT TANKS.** German Patent DS 1957-685. Issued May 24, 1978. Derwent German Patents Abstracts, Vol. A, No. 22, p 1, July, 1978.

Descriptors: \*Sludge treatment, \*Hydraulic design, \*Patents, \*Settling basins, \*Hydraulic structures, Pipes, Engineering structures, Design

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

data, Equipment, Waste water treatment, Separation techniques, Municipal wastes.

A sludge scraper bridge apparatus has been patented for dual waste water tanks. One end of the sludge scraper mechanism is supported on a winch-driven trolley located on the central partition between the tanks. The winch is directed by a circular guide pipe. The sludge scrapers are mounted on two webs attached to either side of the trolley. The other end of the scraper bridge assembly is supported by three radial guide rollers on the outer treatment tank wall; one guide roller is mounted on a horizontal axis. The free ends of the two scraper webs have free-moving castors which roll along the tank wall. The simple design of the scraper bridge provides efficient operation, even under heavy snow conditions. (Lisk-FIRL) W78-12166

#### REACTION WHEEL WASTE WATER SPRAY FOR PERCOLATING FILTER BED - SPRAYS TWO CONCENTRIC BEDS FROM DIFFERENT SOURCES OF LIQ.

French Patent FR 2364-066. Issued May 12, 1978. Derwent French Patents Abstracts, Vol. A, No. 23, p 3, July, 1978.

Descriptors: \*Spraying, \*Application equipment, \*Percolation, \*Filtration, \*Patents, Design data, Sprays, Equipment, Percolating water, Application methods, Waste water treatment, Municipal wastes.

A patented reaction wheel sprayer system permits simultaneous spraying of liquids from two separate sources onto concentric trickling filter beds. Two coaxial sets of radial spray arms, mounted on the reaction wheel, rotate the wheel horizontally to distribute the effluent. A vertical central pipe supplies liquid to one set of spray arms connected to a rotating hollow hub with sleeves. An annular rotary jacket, coaxially enclosing the hollow hub, provides a channel for the liquid supplied to the second set of radial arms. The reaction wheel assembly is rotary seal-mounted on a fixed support box which conveys the liquid effluent to the rotary jacket. The reaction wheel system permits the space-saving concentric filter bed configuration via its ability to simultaneously or separately distribute two different effluents. The spray arms are designed to rotate independently or integrally, depending upon the fixed or rotating attachment of the rotary jacket to the hollow hub. (Lisk-FIRL) W78-12170

#### APPARATUS FOR FORMING SEWAGE TREATMENT SILICATE PRODUCTS - INCLUDES MIXING TUBE WITH STATIC HIGH SHEAR DEVICE.

Netherlands Patent NL 7614-162. Issued June 22, 1978. Derwent Netherlands Patents Report, Vol A, No 27, p 1, August, 1978.

Descriptors: \*Coagulation, \*Silicates, \*Alkali metals, \*Aluminum, \*Patents, Mixing, Dispersion, Salts, Shear, Design data, Intakes, Outlets, Waste water treatment, Municipal wastes.

A high-shear mixing tube apparatus has been patented for the production of a complex aluminum silicate compound used for coagulating waste water. The mixing tube is equipped with two or more inlets, one outlet, and stationary shear devices located along the internal channel. Water is fed into the second inlet and a soluble aluminum salt is introduced into the tube through one of the other outlets. The inner baffles cause the two feed streams to spiral through one tube and mix to form a stable aqueous dispersion which is recovered at the outlet. The outlet solution pressure is about 40 lbs/sq inch less than the initial inlet pressure. The static shear mixing of the solutions produces a material containing up to 5% silicate as SiO<sub>2</sub> with a pH ranging 3.0-7.5, determined by the silicate con-

tent; the dispersion products, used as a coagulant in waste water treatment, is soluble in hydrochloric acid. The static configuration of the mixing apparatus provides high shear mixing with low control requirements. (Lisk-FIRL) W78-12180

#### REMOVING ORGANIC MATERIAL, NITROGEN CPDS. AND PHOSPHATE(S) FROM WATER - BY COMBINED USE OF MICROORGANISMS AND POWDERED MINERAL.

French Patent FR 2364-859. Issued May 19, 1978. Derwent French Patents Abstracts, Vol. A, No. 24, p 3, July, 1978.

Descriptors: \*Calcite, \*Mineralogy, \*Biological treatment, \*Nutrient removal, \*Patents, Organic compounds, Biodegradation, Aeration, Settling basins, Nitrification, Denitrification, Chemical precipitation, Oxidation, Biomass, Activated sludge, Separation techniques, Waste water treatment, Municipal wastes.

A patented process to remove organic compounds and nutrients from waste water with a powdered mineral and microorganisms requires fewer stages and smaller treatment equipment than conventional methods. From 1-200 g/liter of finely powdered calcite, hematite, or gibbsite with particle sizes of <0.297 mm is sustained as a microbial growth medium. The microorganism-bearing mineral is mixed with waste water in an oxidation zone where the dissolved oxygen concentration is maintained at 1-2 mg/liter. Biodegradable solids are oxidized to CO<sub>2</sub> and nitrogen compounds are oxidized to nitrates and nitrites; the powdered metal ions simultaneously precipitate phosphorus from the effluent. The O<sub>2</sub> concentration of the waste water is <1 mg/liter when it is transferred to the settling zone. Phosphate precipitation and denitrification continue in the settling area where the dissolved O<sub>2</sub> concentration diminishes to <0.5 mg/liter. The biomass and solids are allowed to settle; effluent, bearing residual biomass, is then transferred to the clarifying zone where an O<sub>2</sub> concentration of <1 mg/ml is maintained. Clarified effluent is decanted from the tank and the activated sludge is either returned to the initial oxidation tank or aerated and recycled to the clarifier. (Lisk-FIRL) W78-12194

#### LIQUOR REMOVAL FROM LAGOON SURFACES - USING FLOATING TAKE OFF LINE WITH COMPENSATION FOR LEVEL CHANGES.

For primary bibliographic entry see Field 8C. W78-12195

#### REMOVAL OF ORGANIC COMPOUNDS FROM AQUEOUS INDUSTRIAL EFFLUENTS - BY CONTACTING THE LATTER WITH ATMOSPHERIC OXYGEN IN PRESENCE OF HYDROGEN PEROXIDE.

Soviet Patent SU-567-683. Issued August 25, 1977. Derwent Soviet Inventions Illustrated, Vol A, No 24, p 12, July, 1978.

Descriptors: \*Chemical wastes, \*Oxidation, \*Atmospheric pressure, \*Patents, \*Alcohols, Acids, Aeration, Oxygen, Organic compounds, Autoclaves, Heat treatment, Pressure, Waste water treatment, Industrial wastes.

A patent has been issued for an oxidation process utilizing hydrogen peroxide and atmospheric oxygen to remove organic compounds from chemical plant effluents. Hydrogen peroxide is added to the effluent in an amount which is 10-30% of the stoichiometric quantity required for reaction with the organic compounds; the temperature is maintained at 140-160°C. In an example cited, none liter of effluent from the production of organosilicon lacquers, bearing 6 g/liter ethanol and 6.5 g/liter butanol, was placed in an autoclave and mixed

with 16.1 g/liter hydrogen peroxide, equivalent to 25% of the amount required for the complete oxidation of alcohol. The effluent was oxygenated for 60 min at 150°C and an air pressure of 30-50 atm. No alcohols were present in the treated effluent. (Lisk-FIRL) W78-12222

#### CONCENTRATING AQUEOUS EFFLUENTS CONTAINING CALCIUM SULPHATE AND GLYCEROL - BY SPRAYING INTO HOT GAS STREAM, USING INSUFFICIENT HEAT TO CAUSE COMPLETE DRYING.

Netherlands Patent NL 7613-246. Issued May 30, 1978. Derwent Netherlands Patents Report, Vol A, No 24, p 1, July, 1978.

Descriptors: \*Heat treatment, \*Gases, \*Calcium sulfate, \*Food processing industry, \*Patents, Saturation, Drying, Dewatering, Evaporators, Spraying, Design data, Waste water treatment, Industrial wastes, Oilseed crops.

A patent has been issued for a calcium sulfate and glycerol concentration process in which aqueous effluents from edible oil processing are sprayed into a hot gas stream. The effluent is condensed to a higher dry solids content than the saturation point by employing a quantity heat that is insufficient to completely dry the effluent. The temperature difference of the hot gas between entering and leaving the system is maintained at a value lower than that required to completely evaporate the liquid effluent. This process is considered more efficient than combustion, which can have high energy requirements for low waste concentrations. Conventional evaporation can result in saturation as the effluent concentration increases. Caking caused by the glycerol can occur when spray drying is employed for concentrating the effluent. (Lisk-FIRL) W78-12223

#### OIL REMOVAL FROM AQUEOUS WASTE EMULSIONS - USING CATIONIC SURFACTANTS, E.G. PRIMARY AMINE(S) AS FLOTATION AGENTS.

Soviet Patent SU-567-681. Issued August 25, 1977. Derwent Soviet Inventions Illustrated, Vol A, No 24, p 12, July, 1978.

Descriptors: \*Flotation, \*Cations, \*Surfactants, \*Patents, \*Oily water, Foam separation, Oil industry, Aeration, Emulsions, Separation techniques, Waste water treatment, Industrial wastes.

A patent has been issued for an oil flotation process which alleviates the need for strict pH control and reduces the flotation agent concentration by utilizing cationic surfactants. Preferred cationic surfactants include primary amines, polyethylene polyamine, or colophony amine acetate. The process involves carrying a 50 by 300 mm flotation column with 200 ml of emulsified stable machine oil in particle sizes ranging over 0.5-5.0 micrometers. The oil concentration in the pH 6.5 emulsion is 500 mg/liter; 4 mg/liter of colophony amine acetate in an 0.1% aqueous solution or another one of the recommended cationic surfactants is added to the emulsion. The column is aerated through its porous base for 20 min at a rate of 120 ml/min. The process, which is operational at pH 4-10 and 15-60°C, can reduce the residual oil concentration in the emulsion to 3 mg/liter. The cationic flotation process is applicable to effluents from the petroleum, metal, and food processing industries. (Lisk-FIRL) W78-12224

#### METHOD OF TREATING WASTE WATER WITH ACTIVATED SLUDGE,

Idemitsu Kosan Co. Ltd., Tokyo (Japan). (Assignee). Y. Kobayashi, M. Iwata, S. Yoshida, and H. Akatuka.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Waste Treatment Processes—Group 5D

United States Patent 4,105,546. Issued August 8, 1978. Official Gazette of the United States Patent Office, Vol. 973, No. 2, p. 736, August, 1978. 1 fig.

Descriptors: \*Activated sludge, \*Oily water, \*Oil wastes, \*Organic compounds, \*Patents, \*Chemical oxygen demand, Oil industry, Hydraulic design, Waste water treatment, Industrial wastes.

A patent has been issued for an activated sludge process to treat oily waste water by adding a mineral oil hydrocarbon. The hydrocarbon fraction, bearing 4-20 carbon atoms/molecule, is added in a volume that is between 0.0000275 and 0.0000625 times the product of the sludge concentration, the aeration tank capacity reduced by a factor of 0.06, the flow rate, and the COD level of the waste water. Additional reactor parameters maintained during treatment include: 1,000-8,000 ppm activated sludge; an aeration tank capacity of 1,000 cu m; 30-65 ppm COD; and a flow rate of 50-140 cu m/hr. After mineral oil addition, the waste water is mixed with the activated sludge during aeration for a period adequate to reduce the COD concentration. The mixture is then passed to a sedimentation tank for separation of sludge and effluent. (Lisk-FIRL)

W78-12235

### ACTIVATED SLUDGE DEGRADATION OF NITROTRIACETIC ACID (NTA)—METAL COMPLEXES.

Environmental Protection Service, Ottawa (Ontario). Wastewater Technology Centre. For primary bibliographic entry see Field 5B.

W78-12250

### SOURCES OF METALS AND METAL LEVELS IN MUNICIPAL WASTEWATERS.

Ontario Ministry of the Environment, Toronto. Pollution Control Branch. For primary bibliographic entry see Field 5B.

W78-12251

### APPARATUS FOR PURIFYING SEPTIC TANK EFFLUENT.

J. LaRaus. United States Patent 4,104,166. Issued August 1, 1978. Official Gazette of the United States Patent Office, Vol. 973, No. 1, p. 278, August, 1978. 1 fig.

Descriptors: \*Ozone, \*Septic tanks, \*Filtration, \*Storage tanks, \*Patents, Atmospheric pressure, Pipelines, Intakes, Outlets, Equipment, Design data, Waste water treatment, Domestic wastes.

A septic tank waste treatment system which purifies filtered effluent in a series of ozonation tanks has been patented. A large tank, laid adjacent to the septic tank, contains a smaller filter through which septic tank effluent passes at atmospheric pressure for solids removal. The filter tank inlet is connected to a septic tank effluent conduit; the effluent passes through a filter towards an outlet at the opposite end of the filter tank. Connected to the outlet are multiple ozonation tanks arranged in series within the large tank. The ozonation tanks, connected to an external gas supply system, are arranged to form a 16-ft long configuration. Effluent passing through the last tank in the series is discharged into the storage area formed by the unoccupied space between the large exterior tank and the filter and ozone tanks. Excess treated effluent is discharged from the storage space through an outlet leading from the last ozonation tank to a soil disposal field. (Lisk-FIRL)

W78-12263

### ELIMINATION OF ODORS FROM ORGANIC WASTES.

Weiss and Co., Stockholm (Sweden). (Assignee).

J. Weiss.

United States Patent 4,108,771. Issued August 22, 1978. Official Gazette of the United States Patent Office, Vol. 973, No. 4, p. 1820, August, 1978.

Descriptors: \*Chemical precipitation, \*Odor, \*Oxidation, \*Sulfur compounds, \*Patents, Iron compounds, Solubility, Nitrates, Alkali metals, Waste water treatment, Sewage sludge, Air pollution, Municipal wastes.

A process for eliminating odor-producing organic compounds from domestic wastes, organic industrial wastes, and sewage sludge by means of an aqueous acid solution and an oxidizing agent has been patented. The wastes are mixed with a sufficient volume of an aqueous solution containing alkali metals, 3-25% by weight sulfuric acid 3-20% by weight of an oxidizing agent, and 10-40% of a sulfur precipitating agent. The oxidizing agent is selected from a group of water soluble compounds including persulfates, nitrates, and chlorates; permanganates of ammonium and alkali metals are added to oxidize and deodorize the wastes. The sulfur precipitating agent is selected from the water soluble ferrous or ferric compound groups. The waste water is maintained at a pH of 6.5 or less during deodorization. (Lisk-FIRL)

W78-12265

### APPARATUS FOR PURIFYING WASTE WATERS.

United States Patent 4,104,167. Issued August 1, 1978. Official Gazette of the United States Patent Office, Vol. 973, No. 1, p. 278, August, 1978.

Descriptors: \*Equalizing reservoirs, \*Aerated lagoons, \*Activated sludge, \*Settling basins, \*Patents, Separation techniques, Design data, Aeration, Equipment, Waste water treatment, Municipal wastes.

A patent has been issued for a waste water treatment apparatus containing equalization, aeration and sludge separation, and clarification zones. Waste water in the equalization zone is transferred into the top of a second tank which is divided into aeration and sludge separation zones by an inclined plate. Spaced apart from the tank floor and sides, the plate defines an upper, triangular aeration zone and the lower sludge settling area; an intake aeration channel is located in the lower corner of the tank and an outlet is positioned in the upper regions of the tank. Waste water bearing activated sludge is circulated up through the aeration channel and down through the aeration zone; the lower end of the slanted plate inhibits the circulation of the aerated water and increases the velocity along the bottom of the tank. A portion of the rapidly moving water enters the sludge separation zone where a fluidized bed of active media is formed. Effluent moving up through the fluidized bed is drawn into the clarification tank from the top of the sludge separation zone. (Lisk-FIRL)

W78-12268

### WET AIR OXIDATION: EFFECT ON SLUDGE COMPOSITION.

Purdue Univ., Lafayette, IN. Dept. of Agronomy. For primary bibliographic entry see Field 5E.

W78-12269

### REAL TIME CONTROL OF STORAGE IN A COMBINED SEWER SYSTEM.

Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering. B. H. Bradford.

In: Proceedings of the National Symposium on Urban Hydrology, Hydraulics, and Sediment Control, July 1976. UKY BU111, College of Engineering, University of Kentucky, Lexington, December, 1976, p. 287-296. 11 fig, 8 ref. OWRT C-6174(5218) (2).

Descriptors: \*Combined sewers, \*Water pollution control, \*Linear programming, \*Methodology,

\*Optimization, \*Alternative planning, \*Storage, Constraints, Computers, Detention storage, Aggregation, Mass balance, Sanitary sewage systems.

A control algorithm for automated operational management of detention storage in a combined sewer system is applied to a version of the proposed San Francisco Master Plan for Waste-water Management. The system is modeled with control objectives and physical system constraints expressed as a large scale linear programming problem. The algorithm presented transforms the large scale control problem to a multi-level series of smaller subproblems which are amenable to computer solution in real time. The objective of the control for the combined storm water and sanitary sewage systems is to minimize street flooding and overflow of untreated sewage and to maximize the delivery to the treatment plant. The problem's 2000 variables and 1000 constraints are aggregated into a multi-level control algorithm of 39 linear programming problems amenable to computer solution in real time. Four example situations have been selected to simulate the use of the control algorithm for real time operation of the system. The control algorithm determines the operation of each detention reservoir in the system based on a predicted spatially and temporally varied storm. Results of the examples indicate the success of the methodology in obtaining optimal or nearly optimal solutions to the large scale problem in real time. (See also W77-10846; W75-05608; W75-04552) (Bell-Cornell)

W78-12286

### ORGANIZATION OF SANITARY PROTECTION OF THE ENVIRONMENT (AIR, WATER BODIES, WATER SUPPLY, SOIL) IN DONETSK (IN RUSSIAN).

Donetsk Municipal Sanitation Disinfection Station (USSR).

V. P. Grishchenko, N. V. Grin, and V. I. Solovov. Gig Sanit (5), p. 78-83, 1977.

Descriptors: \*Water quality standards, Environment, Water supply, Soils, Public health, Potable water, \*Industrial wastes, Water pollution control, \*Water reuse, Treatment facilities, \*Ukrainian-SSR, USSR.

Sanitary protection of the environment in the large industrial center of Donetsk (Ukrainian SSR, USSR) is described. Key elements include oversight of construction plans and zoning by the municipal sanitation bureaucracy, laboratory monitoring of the content of noxious substances in the atmosphere and water bodies of the city, testing of industrial devices for pollution control and furthering experimentation and implementation of re-use of industrial water effluents, improvement of sewer systems and demineralization of mine water effluents.—Copyright 1978, Biological Abstracts, Inc.

W78-12287

### HYGIENIC ASSESSMENT OF THE EFFECTIVENESS OF BIOLOGICAL TREATMENT OF EFFLUENT FROM SLEEPER IMPREGNATION PLANTS (IN RUSSIAN).

Moskovskii Gosudarstvennyi Meditsinskii Inst. (I) (USSR).

M. V. Bodganov. Gig Sanit 11, p. 40-44, 1976.

Descriptors: \*Biological treatment, \*Waste water treatment, Effluents, \*Water quality standards, Public health.

A hygienic assessment (using rats, mice and guinea pigs) of biologically treated effluents from sleeper impregnation plants (plant for treating railroad ties) showed their sanitary-toxicologic index to be most important. In respect to this index the effluents should be diluted at least 250 times. The quality of water in a water body, wherein the



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

biologically treated effluents from the sleeper impregnating plants are discharged, did not meet the hygienic requirements.—Copyright 1978, Biological Abstracts, Inc. W78-12296

**PROTRACTED RECHARGE OF TREATED SEWAGE INTO SAND: PART II - TRACING THE FLOW OF CONTAMINATED GROUND WATER WITH A RESISTIVITY SURVEY.** Rensselaer Polytechnic Inst., Troy, NY. W. B. Fink, Jr., and D. B. Aulenbach. Contribution No. 166 from the Eastern Deciduous Forest Biome, US-IBP, FWI Rpt. 74-4, (1974). 12 p.

Descriptors: Recharge, Sands, Sewage treatment, Waste water treatment, Path of pollutants, Treatment facilities, Biochemical oxygen demand, Nitrogen, Phosphorus, Coliforms, Waste disposal, Chlorides.

To aid in determining the direction of groundwater flow after the effluent from the Lake George Village sewage treatment plant is discharged onto natural delta sand beds, resistivity studies were made in the soil (sand) in the vicinity of the recharge beds. Groundwater having high dissolved solids is identified as producing lower resistivity readings. The sewage effluent has a higher dissolved solids content than the existing groundwater in the area. The path of the recharged sewage effluent, as identified by lower resistivity readings, appears to flow in a northerly direction from the sewage treatment plant along Gage Road toward West Brook. Due to interferences, the resistivity studies could not show whether the high conductivity groundwater flows into or under West Brook. (Rensselaer) W78-12305

**PROTRACTED RECHARGE OF TREATED SEWAGE INTO SAND: PART I - QUALITY CHANGES IN VERTICAL TRANSPORT THROUGH THE SAND.** Rensselaer Polytechnic Inst., Troy, NY. D. B. Aulenbach, T. P. Glavin, and J. A. Romero Rojas. Contribution No. 165 from the Eastern Deciduous Forest Biome, US-IBP, FWI Rpt. 71-1, (1974). 25 p.

Descriptors: \*Recharge, Sands, \*Sewage treatment, \*Waste water treatment, Path of pollutants, Treatment facilities, Biochemical oxygen demand, Nitrogen, Phosphorus, Coliforms, \*Waste disposal, Chlorides.

When the Lake George Village Sewage treatment plant was put into operation in 1939, it was described as a 'complete treatment' plant. This was because the treated effluent is discharged onto natural delta sand seepage beds which are 'at least 25 deep.' Studies were made to determine the removal efficiency in the sand beds of coliforms, BOD, chlorides, and the nitrogen and phosphorus compounds. It was found that when beds were dosed, they were no longer saturated with water at 15 feet. Ten feet of sand were found to remove coliforms by 99% and BOD by 96%. However, nitrates, phosphates, and chlorides remained in significant concentrations after filtration through 10 feet of sand. Phosphate removal in an infrequently used sand bed was greater than in a continuously used bed. (Rensselaer) W78-12306

**EXPERIMENTAL TREATMENT OF WASTE EFFLUENT FROM CHEMICAL PLANTS 'POLICE' BY USING IT IN CARP CULTURES.** Wyszka Szkoła Rolnicza, Szczecin (Poland). Dept. of Hydrozoology. L. Szlaver. Polskie Archiwum Hydrobiologii, Vol 24, No 4, p 593-602, 1977. 6 tab, 10 ref.

Descriptors: \*Chemical wastes, \*Carp, \*Fry, \*Biological treatment, Industrial wastes, Animal growth, Fertilizers, Nutrients, Nitrogen compounds, Effluents, Sewage treatment, Water pollution sources, Phytoplankton, Zooplankton, Growth rates, Aquaculture.

Waste effluents from chemical plants producing mineral fertilizers, containing 0.147 g N/l, were applied to ponds stocked with fry of carp. The obtained production was 1210 kg/ha (without additional food supply) and the reduction of nitrocompounds-1.15 N mg/l per day. (EIS-Deal) W78-12373

**RECYCLING AND DISPOSAL OF PLASTICS WASTE IN SOUTH AFRICA.** Council for Scientific and Industrial Research, Johannesburg (South Africa). R. H. Nurse, N. C. Symington, G. R. de V. Brooks, and L. J. Heyl. South Africa National Scientific Programmes Unit, Report No 4, 1976. 14 ref, 13 tab, 2 fig.

Descriptors: \*Solid wastes, \*Plastics wastes, \*Recycling, Wastes recovery, Polyethylene, Polyvinyl chloride, Polystyrene, Polypropylene, Resources conservation, Wastes utilization, Waste disposal, Landfills, Consumption, \*South Africa.

Only the main thermoplastic types (high and low density polyethylene, polyvinyl chloride, polystyrene and polypropylene) are recyclable. These plastic types represent 67% of the total consumption of plastics in 1974. Approximately 130 000 tons of plastic waste generated in 1975 were available for recycling. Economic gain for the recycler is the strongest motivation for recycling. Resource conservation, reduction of waste disposal costs and ecological considerations are less important factors. Approximately 15 000 tons, or 12% of recyclable plastic is currently being recycled. A growth rate in recycled plastic of 12.5% per annum is expected until 1981. Due to the fact that plastic wastes provide no special problems in currently used waste disposal systems, it is concluded that there is no need for further research directed specifically at the disposal aspect of plastic in urban waste. (So Afr Water Info Ctr) W78-12399

**SIMPLIFICATION OF WASTE WATER PROBLEMS THE FABRIC LINED PURIFICATION PLANT.** Civil Engineering Contractor (Johannesburg), Vol. 10, No. 9, p 34-35, 1976. 1 illustr.

Descriptors: \*Waste water treatment, \*Linings, \*Plastics, Deodorization, Low costs, Inflatable structures, Seepage control.

Describes European trends in wastewater treatment, where Germany which discharges 50 per cent of its waste water unpurified is aiming at attaining Sweden's low percentage of only 10%. The predominant need is for small and medium sized plants. A short description is given of two experimental economic compact systems at Simmern and Greetel. (So Afr Water Info Ctr) W78-12415

**RESOURCES DEPLOYED IN WATER RE-USE,** Pretoria Univ. (South Africa). For primary bibliographic entry see Field 3C. W78-12422

**MODERN WATER RECLAMATION PLANT IN WINDHOEK,** J. P. Kriel. Municipal Engineer, (Johannesburg), Vol. 8, No. 1, p 27-31, 1977.

Descriptors: Domestic water, \*Waste water treatment, Wastewater treatment plant design, Potable water, Fish, Sewage treatment, Water reuse, Sampling, \*Treatment facilities, Windhoek wastewater reclamation plant, \*South Africa.

The modernised water reclamation plant, recently presented to the City Council of Windhoek, is described. The plant, which has been designed for a capacity of 200m<sup>3</sup> per hour, and is capable of producing 20% of Windhoek's water requirements, incorporates the latest research results generated by the CSIR's National Institute for Water Research. Using a flow diagram a step by step account is given of the reclamation process. The construction materials and flow information is given and a description is given of the constant attention that is being paid to maintaining the quality of the product and the optimisation of the plant. (So Afr Water Info Ctr) W78-12428

**ADVANCED SEWAGE TREATMENT PLANT WITH COMPUTER-BASED CONTROL EQUIPMENT.** Municipal Engineer, (Johannesburg), Vol. 8, No. 1, p 70-71, 1977.

Descriptors: \*Sewage treatment plants, \*Municipal wastewater, Process control, Control equipment, Safety aspects, Activated sludge process, Automatic instrumentation, Metering, Computers, Equipment description, Personnel management, \*Waste water treatment, South Africa.

The Anglian Water Authority is operating one of the world's most advanced sewage treatment works at Whittingham, incorporating a computer based process control system which allows most of the sewage treatment processes to be carried out under remote automatic control. The operations controlled by the computer include two different types of sewage treatment plant-the traditional biological filter system and the activated sludge system. The application of automatic control at Whittingham should eliminate many unpleasant manual tasks, while producing plant economics, increasing plant efficiency and flexibility to adapt to the rapidly changing content of sewage. In addition the system functions as a management information unit providing essential operational statistics and bulk material storage figures such as fuel and oil reserves, and antifoam additive. It also provides a complete log of all plant states every twenty-four hours or on demand. (So Afr Water Info Ctr) W78-12430

**ADVANCED SOLUTIONS TO POLLUTION PROBLEMS IN SOUTH AFRICA.** Johannesburg City Health Dept. (South Africa). J. L. Barnard, and D. W. Osborn. Municipal Engineer, Vol. 7, No. 3, p 33-35, 37-40, 1976. 9 ref, 7 fig, 2 tab.

Descriptors: \*Pollution abatement, Water resources augmentation, \*Sewage treatment, Water re-use, Trickling filters, Effluent quality, Nitrogen removal, Pilot plants, Phosphorus removal, Bardenpho process, Denitrification, Extended aeration, Activated sludge process, Industrial wastes, \*South Africa.

As a result of the close co-operation between the Research organisations and the local authorities in South Africa, new treatment methods are readily accepted and incorporated in the designs for new plants. This has already led to the construction of activated sludge plants for large sewage treatment works on the principle of extended aeration, while complete denitrification using internal carbon sources and phosphate removal using the luxury uptake principle is being incorporated into many large new plants now being designed and built in South Africa. The design of such plants also

makes allowance for the addition of any other units that may be required to make the effluents produced, suitable for eventual re-use or total reclamation. (So Afr Water Info Ctr) W78-12438

**DESIGN OF FLOCCULATION SYSTEMS FROM BATCH TEST DATA.**  
Cape Town Univ. (South Africa).  
J. Bratby, and M. W. Miller.  
Water South Africa, Vol 3, No 4, p 173-182, 1977. 17 ref, 8 fig.

Descriptors: \*Design data, \*Flocculation, Batch processes, Complete mixing systems, Plug flow, Continuous processes, Comparison, Process performance, Costs, Optimization, Velocity gradients, Kinetics, Water treatment, \*Waste water treatment, \*South Africa.

Up to the present time, for the design of continuous completely mixed flocculation systems, it has been necessary to obtain experimental data by performing continuous type pilot plant trials. Because of the considerable expenditure involved in constructing the necessary apparatus and the lengthy testing procedures involved, design of flocculation systems (especially for relatively small plants) has often been based on rule of thumb procedures. In this paper the theoretical principles and experimental procedures are set out by which it is possible to obtain design data for continuous completely mixed flocculation systems using batch test results only. The validity of the theoretical link between batch type (or plug flow) behaviour and continuous type performance, presented in the paper is checked by comparing the data gained from continuous and batch test data. The principles set out should prove considerable value to design engineers faced with the problem of designing flocculation systems in which both performance and total costs require optimisation. (So Afr Water Info Ctr) W78-12489

#### OBSERVATIONS ON ALGAL POPULATIONS IN AN EXPERIMENTAL MATURATION POND SYSTEM.

Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research.  
S. N. Shillinglaw, and A. J. Pieterse.  
Water, South Africa, Vol. 3, No. 4, p 183-192, 1977. 16 ref, 10 fig, 4 tab.

Descriptors: \*Algal populations, \*Polishing ponds, \*Sewage treatment, \*Nutrient removal, Ammonia nitrogen, Carbon deficiencies, Retention time, Water reuse, Algal metabolism, Population dynamics, Chlorophyll, Suspended solids, Zooplankton, Dissolved oxygen, Temperature effect, Nitrate nitrogen, Orthophosphate, South Africa.

A dense algal population is of primary importance in sewage maturation ponds for the removal of plant nutrients, especially ammonia and orthophosphate. In the Republic of South Africa and in South West Africa sudden algal population declines have occurred at times in maturation ponds. These declines cause serious problems in the reclamation of purified sewage effluents for re-use. The possible causes of these declines are considered here from the physical, biological and chemical observations of an experimental maturation pond system. The algal populations of the system fluctuated from very high to very low cell concentrations. High algal cell concentrations were only maintained for short periods of time. Zooplankton grazing was responsible for removing algae from the system at times but this was not the primary cause of all the algal population declines. It is very likely that sudden increases in ammonia nitrogen concentration when the pH was high, caused the algal population declines. Carbon deficiencies could have occurred during peak algal cell

concentrations which would have resulted in population declines. A possible means of preventing the algal population declines could be by increasing the retention period of the pond system. The results confirmed that dense algal populations removed plant nutrients efficiently from the pond system. (So Afr Water Info Ctr) W78-12490

**THICKENING OF BROWN WATER SLUDGES BY DISSOLVED-AIR (PRESSURE) FLOTATION.**  
Cape Town Univ. (South Africa).  
J. Bratby, and GvR. Marais.  
Water S A, (Pretoria), Vol. 3, No. 4, p 202-212, 1977, 7 ref, 24 fig.

Descriptors: \*Sludge thickening, \*Pressure flotation, Cationic polyelectrolytes, Dosage, Water treatment, Colour, Humic acids, Fulvic acid, Water wastage, Sludge volume, Sludge disposal, Process variables, Model studies, Activated sludge, Mixed liquor, Flow rate, Continuous processes, Effluent quality, Suspended solids, Costs, South Africa.

A model describing the inter-relationships influencing dissolved-air (pressure) flotation systems, developed earlier for activated sludge, is verified using the settled sludge derived from the treatment of brown waters from the Table Mountain catchment area. For efficient flotation, a cationic polyelectrolyte at an optimal dosage of 0.05g kg<sup>-1</sup> needs to be added to the brown water sludge. The effluent from the flotation unit treating the settled sludge was comparable to that from the sedimentation basins. Float solids' concentrations up to 12% (12 g/l) were achieved by flotation. This concentration is compared to a value of 2500mg l<sup>-1</sup> achieved by the settled sludge after chemical addition and settling in the plant. Taking the maximum flow handled by the plant as 18Mld-1 the water wasted with the sludge is approximately 450m3d-1, ie 2.5% of the total flow. By applying flotation to thicken the waste brown water sludge to 12% would reduce the wastage to 9m3d-1, ie 0.05% of the total flow. This has a further important implication when considering possible subsequent sludge disposal operations where the required handling capacity of such facilities is reduced by 98%. Running costs associated with polyelectrolyte addition and power requirements of a flotation system to thicken the waste sludge from a plant treating brown waters would constitute a mere increase of 1.43% of the present overall running (chemical) costs. (So Afr Water Info Ctr) W78-12492

#### HYACINTH LAGOONS- LOW-COST SEWAGE TREATMENT.

J. Joseph.

Municipal Engineer, Vol. 8, No. 5, p 13-17, 1977.

Descriptors: \*Water hyacinth, Low cost, \*Sewage treatment, \*Aquatic weed control, Cleanup procedure, Water pollution, Water purification, Pollutants removal, Harvesting, Biocontrol, Sewage ponds, Filtration, Absorption, Chemical composition, Eichhornia crassipes, South Africa.

An effective water purification system is within the reach of even the smallest community. The water hyacinth, a fast-growing 'wonder weed', provides a natural technique for ridding sewage and industrial effluent of pollutants. The system is the newest innovation in pollution clean-up and may hold the key to low-cost treatment of community and industrial wastewater. (So Afr Water Info Ctr) W78-12495

**MICROBIAL TREATMENT OF AN INDUSTRIAL EFFLUENT CONTAINING VOLATILE FATTY ACIDS.**  
J. C. Du Preez, and P. M. Lategan.

South African Journal of Science, Johannesburg, Vol 73, No 11, p 349-351, 1977.

Descriptors: Waste disposal, Fatty acids, Microorganisms, Laboratory studies, Fermentors, Acinetobacter, \*Waste water treatment, Sasol, South Africa.

The Sasol oil-from-coal plant produces an aqueous effluent containing approximately 1% (m/v) C2-C5 fatty acids and which thereby creates a waste disposal problem. The investigation reported here was undertaken to determine whether this material could be treated by microorganisms and, if so, whether they could utilize these fatty acids as their sole carbon source. A possible benefit of such a process is the production of single-cell protein (SCP), especially since this effluent is currently of no economic value. The investigation indicated that Acinetobacter could be effective in the treatment of the Sasol effluent for the removal of fatty acids. Furthermore, Acinetobacter would probably be acceptable as a source of SCP. This investigation was undertaken with the financial support of the South African Coal, Oil and Gas Corporation Ltd. (So Afr Water Info Ctr) W78-12508

#### SOME CRITERIA FOR SELECTION BETWEEN CORRECTION OF THE INDICATIVE FLOW AND THE WASTE TREATMENT EFFICIENCY IN A SMALL RIVER BASIN.

Institute of Meteorology and Water Management, Warsaw (Poland).  
M. Metler, and T. Sedzikowski.  
In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No 125, p 252-261, 1978. 5 fig, 2 tab, 7 ref.

Descriptors: \*River basins, \*Streamflow, \*Waste treatment, \*Efficiencies, \*Water quality, Evaluation, Reservoir construction, Estimating, Construction costs, Graphical analysis, Treatment facilities, Size, Mathematical computations, Cost decrease, Settling tank, Joint operation, \*Economic relationships.

The necessary waste treatment range is frequently determined in relation to the required water quality level as a function of the indicative flow. This paper evaluates the influence of increased indicative flow resulting from construction of reservoirs on the required waste treatment efficiency in a small river basin. It also deals with the estimation of the economic relationships between the construction costs of a reservoir to provide increased indicative flow and the inputs in construction of a waste treatment plant for the increased flow. The basic standard relations have been shown in graphs as a series of mathematical computations. It has been found that although the increase of the indicative flow resulting from construction of reservoirs may not be an economically justified method of maintaining the required water quality level, the interrelations between the reservoirs and the waste treatment plants should not be neglected in the water management system of a river basin. (Bell-Cornell) W78-12535

**WATER QUALITY MODELLING IN SURFACE WATER NETWORKS WITH SPECIAL REGARD TO QUALITY BREAKDOWNS.**  
Institut fuer Wasserrwirtschaft, Berlin (East Germany).  
For primary bibliographic entry see Field 5B. W78-12537

**OPTIMIZATION OF TECHNOLOGICAL PARAMETERS IN AN ACTIVATED SLUDGE SYSTEM AS A FUNCTION OF THE REQUIRED**

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

**WATER QUALITY UNDER VARIABLE CONDITIONS,** Institute of Meteorology and Water Management, Warsaw (Poland).  
M. Metler, and T. Sedzikowski.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, IASA and IAHS jointly. IAHS-AISH Publication No. 125, p 343-350. 1978. 2 fig, 7 ref.

**Descriptors:** \*Activated sludge, \*Optimization, \*Water quality, \*Technological parameters, \*Waste treatment, Standards, Aeration, Biochemical oxygen demand, Equations, Mathematical models, Regulation, Waste quality, Recirculation rate, Sludge concentration, Operation research.

The optimum technological conditions for maintaining the required constant level of pollution discharged from the activated sludge system to the subsequent treatment stages or to surface water have been determined using a mathematical model of the waste treatment based on the activated sludge method. Despite the stochastically variable parameters of the wastes entering the system and the changing level of water quality, it is possible to maintain the required level of waste quality, thanks to the regulation of the suspended sludge in aeration tanks by means of optimum recirculation control. The calculation method and the nomograph presented provide for the determination of the required parameters of the process and they have been supplemented by a hypothetical example. (Bell-Cornell)  
W78-12544

**OPTIMAL PLANNING OF REGIONAL WASTE WATER TREATMENT,** University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.  
D. Stephenson.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, IASA and IAHS jointly. IAHS-AISH Publication No. 125, p 351-360. 1978. 3 fig, 9 ref.

**Descriptors:** \*Waste water treatment, \*Regional development, \*Planning, \*Computer models, \*River basins, \*Optimization, \*Cost minimization, Water supply, Constraints, Pollutants, Treatment facilities, Equations, Systems analysis, Separable programming, Linear programming, Decomposition techniques.

The water resources of South Africa are limited and it may soon become necessary to recycle reclaimed waste water for the Witwatersrand area. Optimum planning of the location of waste water treatment works, sewers, and quality of effluent is needed. It is shown herein how such planning may be accomplished with the assistance of computer models, where the system may be described in terms of equations and constraints, which are linear except for the pollution load balance equations. These equations are in a form suitable for separable programming optimization techniques which can be used to derive least-cost planning alternatives. An optimum river basin plan may be produced and basins linked using decomposition of linear programming techniques. (Bell-Cornell)  
W78-12545

**REGIONALIZATION AND STAGING OF WASTE WATER TREATMENT PLANTS TO MEET WATER QUALITY STANDARDS,** Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

S. L. Klemetson, and W. J. Grenney.  
In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, IASA and IAHS jointly. IAHS-AISH Publication No. 125, p 361-372. 1978. 7 fig, 4 tab, 6 ref.

**Descriptors:** \*Waste water treatment, \*Water quality, \*Standards, \*Regional development, \*Optimization, \*Staging, \*Cost minimization, Treatment facilities, Dynamic programming, Evaluation, Timing, Decision making, Planning, Capacity expansion, Lower Jordan River (Utah), Mathematical models, Systems analysis.

Presented is the Wastewater Treatment Optimization Model (WTOM), developed using dynamic programming to evaluate the timing and capacity expansion alternatives for the regionalization and staging of waste water treatment facilities to meet water quality standards. It was applied to the Lower Jordan River Region of the state of Utah an area of about 450,000 people and various types of light and heavy industry. Among the factors which were considered are the (1) quality and quantity of waste water and its change with respect to time; (2) rate of interest and of inflation; (3) capital, operation, and maintenance costs; (4) treatment efficiencies; (5) economies of scale; (6) excess capacity; and (7) service life. Demonstrated is how this model makes an economic selection of the optimum alternative treatment systems that meet the desired water quality objectives at the lowest future discounted costs. Adjustments of the model to fit regional conditions are possible through the selection of the appropriate cost indices and input data. WTOM allows an inexpensive evaluation of a wide variety of treatment alternatives. (Bell-Cornell)  
W78-12546

**SOME PHYSICAL AND ECONOMIC ASPECTS OF OPTIMIZATION OF THE DEGREE OF WASTE WATER AND WATER TREATMENT,** Technical Univ. of Warsaw (Poland). Inst. of Water Supply and Hydraulics.

R. Milaszewski, and M. Roman.  
In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, IASA and IAHS jointly. IAHS-AISH Publication No. 125, p 373-382. 1978. 5 fig, 1 tab, 9 ref.

**Descriptors:** \*Waste water treatment, \*Water treatment, \*Optimization, \*River sections, \*Economic aspects, \*Physical aspects, Treatment facilities, Constraints, Water quality, Color, Discharge (Water), Wastewater, Equations, Mathematical models, Systems analysis.

This paper discusses the application of optimization models of water and waste water treatment. The optimization problem is considered on the basis of an elementary system, consisting of a waste water treatment plant, a water treatment plant, and the river section between the waste water discharge and the water intake. Connections between the parameters describing this system are the physical basis of the optimization. The problem of the decision variables, optimization criteria, and constraints as well as some chosen examples are also discussed. The absence of a common index to determine the degree of waste water and water treatment makes this problem difficult to solve; herein, color is used as the common index. Besides the several existing methods of formulating optimization models of waste water and water treatment degree, there is still a need for further research on the physical basis of the optimization, e.g., river velocity and depth; it is also necessary to study further the cost functions expressed in terms of plant size and a common index of pollutant removal efficiencies. (Bell-Cornell)  
W78-12547

**STUDIES OF TRACE METALS IN THE WATERS AND SEDIMENTS OF BADFISH CREEK AND LAKE WINGRA, NEAR MADISON, WISCONSIN,** Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 5A.  
W78-12603

**DESIGN, COST ESTIMATION AND OPTIMIZATION OF SEWAGE COLLECTION AND TREATMENT SYSTEMS FOR HOUSING DEVELOPMENT IN THE GLENWOOD, NEW YORK AREA,** Calspan Corp., Buffalo, NY.

L. K. Wang, M. H. Wang, and D. B. Dahm.  
Project Report No. ND-5390-M-1, January 1974.  
97 p, 31 tab, 12 fig, 9 ref.

**Descriptors:** Planning, Systems analysis, Population, Sewage, \*Sewers, \*Sewage treatment, Activated sludge, Trickling filter, Lagoon, \*Cost analysis, Design, \*Waste water treatment, New York, \*Optimization, Physical-chemical treatment, Conventional activated sludge, Extended aeration, Contact stabilization, High-rate activated sludge, Trickling filter, Aerated lagoon.

An economic study of alternate sewage collection and treatment systems was conducted for proposed and existing housing development in the vicinity of Glenwood, New York. Based on the available performance and cost data for selected sewage treatment methods, cost-effectiveness tradeoffs were examined for different alternative strategies: (1) expanding the existing sewage treatment plant to handle the projected population growth; and (2) selecting and designing a new sewage treatment plant for serving the concerned area under different assumptions of participation by existing and projected population centers. Major sanitary sewer lines for transporting the sewage to the proposed sewage treatment plants were considered and their cost estimated. An optimum sewage system from both a technical and economic point of view was delineated by an overall cost optimization analysis.  
W78-12611

**DISCOUNTED FLOOD RISKS IN LEAST-COST DESIGN OF STORM SEWER NETWORKS,** Illinois Univ. at Urbana-Champaign. Dept. of Civil and Ceramic Engineering.

W. H. Tang, L. W. Mays, and H. G. Wenzel.  
In: Stochastic Processes in Water Resources Engineering, Proceedings, Second International IAHR Symposium on Stochastic Hydraulics, Lund Institute of Technology/University of Lund, Sweden, August 2-4, 1976. Lars Gottschalk, et al. (Eds.), Water Resources Publications, Fort Collins, Colorado, 1977, Chapter 13, p 293-318. 7 fig, 5 tab, 14 ref, append. OWRT B-098-ILL(1).

**Descriptors:** \*Flood damage, \*Storm sewers, \*Networks, \*Dynamic programming, \*Evaluation, Design, Installation costs, Hydraulic models, Probability, Risks, Hydrographs, Annual, Inflow, Optimization, Effects, Mathematical models, Equations, Systems analysis, \*Cost minimization, Uncertainties.

A method of evaluating flood damages from storms is formulated considering the uncertainties in predicting storm inflow capacity, the flood volume versus flood depth, and the flood depth versus flood depth relationships for the specific neighborhood. Using hydraulic, cost and probabilistic models, each of seven major factors is studied and analyzed systematically. The present worth of all potential flood damages during the expected service period is combined with the sewer installation cost for a tradeoff analysis within a dynamic programming model for the least-cost design of storm sewer networks. An example is given to illustrate the details of the application to designing a storm sewer network in a typical urban basin. It appears that the potential flood damages have a more significant effect upon the design of the downstream pipes, where flood volumes are more likely to exceed the threshold storage and cause direct physical damages. Moreover, the uncertainties contributed by factors other than the randomness in precipitation should not be ignored in determination of the minimum cost design. (Bell-Cornell)  
W78-12612



# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Waste Treatment Processes—Group 5D

### DRAFT GUIDELINES FOR AREA-WIDE WASTE MANAGEMENT PLANNING. SECTION 208, FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972.

Environmental Protection Agency, Washington, DC.  
For primary bibliographic entry see Field 5G.  
W78-12658

### PRETREATMENT OF THE COMBINED INDUSTRIAL-DOMESTIC WASTEWATERS OF HAGERSTOWN, MARYLAND—VOLUME I, Kappe Associates, Inc., Rockville, MD.

D. S. Kappe.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 506. Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency, Ada, Oklahoma, Report EPA 600/2-78-043a, Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, February 1978. 99 p, 8 fig, 72 tab, 3 ref. 11060 EJD, EPA 600/2-78-043a.

Descriptors: \*Biochemical oxygen demand, \*Sewage treatment, \*Activated sludge, \*Settling tanks, \*Waste water treatment, \*Pretreatment(Water), \*Oxygen demand, Hydrogen sulfide, Water pollution, Water pollution control, Biological treatment, Maryland, Hagerstown(MD), Grit chambers, Aeration tanks, Volatile organics, Industrial pollution.

The city of Hagerstown, Maryland, with a population of over 35,000 persons, is a manufacturing city with about 130 industrial firms, which are classified in more than 25 different product categories. Thus, the water pollution control plant receives both domestic sewage and a diversity of industrial waste and process waters. This treatment plant was unable to achieve waste water treatment to the degree necessary to meet the requirements of the Maryland Departments of Health and Water Resources. Certain methods of 'pretreating' the city's combined waste waters to render these waters more amenable to the existing conventional biological treatment processes were tried and evaluated. These methods were intended to assist the existing treatment plant in meeting oxygen demands through initial oxidation since the combined waste waters regularly exerted high immediate and ultimate oxygen demands. The methods were diffuse aeration with and without the addition of waste activated sludge, chlorination, sodium nitrate addition, and potassium permanganate addition. Ammoniation was also tried in an effort to destroy some of the more noxious industrial materials in the waste waters. Pretreatment of the municipal waste waters by plain aeration, by aeration with and addition of activated sludge, and by chlorination were most effective in improving the degree of waste water treatment received by the treatment plant. (Coan-NC)  
W78-12660

### FRESHWATER WETLANDS AND SEWAGE EFFLUENT DISPOSAL: PROCEEDINGS OF A NATIONAL SYMPOSIUM HELD AT THE UNIVERSITY OF MICHIGAN.

For primary bibliographic entry see Field 5E.  
W78-12707

### PLANT GROWTH, NUTRIENT ACCUMULATION AND DECOMPOSITION IN A CENTRAL MICHIGAN PEATLAND USED FOR EFFLUENT TREATMENT.

Michigan Univ., Ann Arbor. School of Natural Resources.  
For primary bibliographic entry see Field 5C.  
W78-12711

### SEWAGE SPRAY IRRIGATION IN A DELAWARE RIVER FRESHWATER TIDAL MARSH.

Rider Coll., Trenton, NJ. Dept. of Biology.

For primary bibliographic entry see Field 5E.  
W78-12712

### MARSH/POND SEWAGE TREATMENT PLANTS.

Brookhaven National Lab., Upton, NY. Dept. of Applied Science.  
M. M. Small.  
In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 197-213, 1976.

Descriptors: \*Sewage effluents, \*Freshwater marshes, \*Biological treatment, \*Waste water treatment, Marshes, Ponds, Cattails, New York, Costs, Harvesting, Wildlife, Wetlands.

Brookhaven National Laboratory is operating a 10,000 gallon per day sewage treatment system that consists only of a shallow cattail marsh and a stabilization pond. The influent to this system is raw sewage blended with septage and sludge; the effluent is potable water. The system is odor, rodent, fly and mosquito free. It produces no sludge nor airblown particles. It produces a useful annual crop which is salable and provides suitable habitat for fish, birds, and wildlife. This project is the prototype of similar systems which are proposed for communities of up to 10,000 inhabitants. They can be built at a cost of about \$0.60/gal-day and operated at less than one man-year expense. (See also W78-12707) (Stihler-Mass)  
W78-12715

### ARTIFICIAL AND NATURAL MARSHES AS WASTEWATER TREATMENT SYSTEMS IN WISCONSIN.

F. L. Spangler, W. E. Sloey, and C. W. Fetter, Jr.  
In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 215-240, 1976. 3 fig, 9 tab, 12 ref.

Descriptors: \*Waste water treatment, \*Sewage effluents, \*Biological treatment, \*Freshwater marshes, \*Phosphorus, Wisconsin, Wetlands, Harvesting, Gravels, Biochemical oxygen demand, Suspended solids, Nitrogen, Coliforms, Rooted aquatic plants.

Observations were made on the effect of artificial marshes on primary and secondary municipal treatment plant effluent. Water quality improvement by a polluted natural marsh was also studied. Phosphorus (P) removals of 30 to 40% can be expected in both natural and artificial marshes but ranged up to 65%. Phosphorus removal during the growing season may be negated by loss during winter and spring. Harvesting of plants is not a feasible P removal technique nor does it influence treatment efficiency. In the artificial system, 75% of the P removed from the waste water went into the gravel; only 5% went into harvestable tissue. Most of the purification processes, i.e., BOD removal and nutrient retention, appear to be carried out in the substrate system. Retention time did not seem to be critical to BOD removal over a 5-hour to 10-day range for secondary effluent. (See also W78-12707) (Stihler-Mass)  
W78-12716

### MINNESOTA'S PEAT RESOURCES: THEIR CHARACTERISTICS AND USE IN SEWAGE TREATMENT, AGRICULTURE AND ENERGY.

Minnesota Univ., St. Paul. Dept. of Soil Science.  
R. S. Farnham, and D. H. Boelter.  
In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 241-255, 1976. 12 ref.

Descriptors: \*Peat, \*Minnesota, \*Fuels, \*Agriculture, \*Sewage treatment, \*Hydrology,

Wetlands, Wild rice, Soil amendments, Stream-flow, Nutrient removal, Waste water, Biological treatment.

Minnesota has three million ha (7.5 million acres) of peatland wetlands. One of the more important resources of peatlands is water, and the headwater areas for several major river basins are located on peat-covered wetlands in the northern forested regions of Minnesota. Peatlands often play a less significant role in the seasonal distribution of runoff with a large portion of the annual flow occurring prior to June 15. Drained and fertilized, these organic soils are particularly suited to the production of vegetable, seed, and forage crops, wild rice and other specialty crops. High water storage capacity, and low density make peat materials ideal soil amendments. The relatively high caloric values of peat have led to their use as fuel. Renovation of waste waters is quite good using a combination of the filtering and absorbing action of peat and the harvest of plants growing on the filter beds. (See also W78-12707) (Stihler-Mass)  
W78-12717

### TREATMENT OF SECONDARY EFFLUENT USING A PEAT BED.

Forest Service (USDA), Milwaukee, WI.  
H. T. Stanlick.  
In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 257-268, 1976. 4 fig, 2 ref.

Descriptors: \*Sewage treatment, \*Biological treatment, \*Peat, \*Waste water treatment, Coliforms, Phosphorus, Nitrogen, Biochemical oxygen demand, Suspended solids, Peat beds.

The peat bed consisted of the following layers, from bottom to top: pea gravel, sand, sand and peat mixture, and peat. It was planted with water-tolerant grass. Effluent was applied using a sprinkler system. Operating during the growing season, peat bed effluent should be produced that will meet most, if not all, discharge requirements. Such effluent should have no fecal coliform, little total coliform, BOD5 and suspended solids of approximately 5 mg/l, and nitrogen content of less than 10 mg/l. A system of this type could be used to disinfect and improve the quality of effluent all year if there are no stringent requirements on phosphorus and nitrogen. A peat bed should be designed to handle not more than 0.625 cm/hr and 5-15 cm/day of secondary or primary effluent. A bed life of close to 10 years is expected. After three years, treatment efficiency has not deteriorated, but has increased. (See also W78-12707) (Stihler-Mass)  
W78-12718

### VIRAL ASPECTS OF WETLAND DISPOSAL OF EFFLUENT.

Epidemiology Research Center, Tampa, FL.  
F. M. Wellings.  
In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 297-305, 1976. 1 fig, 6 tab.

Descriptors: \*Wetlands, \*Viruses, \*Sewage treatment, \*Waste water treatment, Biological treatment, Florida, \*Cypress domes, Wetlands.

From a virological standpoint, the effluent from a cypress dome treatment plant serving a small trailer court is relatively comparable with that of urban treatment plant effluent. The quantities of virus entering the plants are comparable, but the variety of virus types entering the dome is limited. Since this dome represented a burned out dome, the efficacy of sewage treatment by an undisturbed cypress dome has not been tested. (See also W78-12707) (Stihler-Mass)  
W78-12720

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

**RECOVERY OF NUTRIENTS FROM PEATLANDS USED FOR TERTIARY TREATMENT,** Michigan Univ., Ann Arbor. Wetlands Ecosystem Research Group.  
D. L. Tilton.

In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 307-327, 1976. 2 tab, 9 ref.

**Descriptors:** \*Peats, \*Waste water treatment, \*Forest management, \*Biological treatment, Soil moisture, Cattails, Trees, Pulp and paper industry, Tertiary treatment, Michigan, Organic soils, Waterfowl, Nitrogen, Phosphorus, Land use.

Analysis of the Porter Ranch Peatland project, Michigan, indicates that low supply of available nutrients, poor soil aeration, light moisture content, and low soil temperature combine to produce a soil environment which is unsuitable for commercial production of most vegetable and field crops. Silviculture of appropriate pulpwood species may be possible on peatlands irrigated with waste water. Forestry provides advantages in harvesting, nutrient storage, and low risk due to heavy metals and viruses. Forestry may not be feasible, however, if waterfowl production is a management goal or if nutrient requirements of the trees are not met by nutrient additions in the effluent. (See also W78-12707) (Stihler-Mass)  
W78-12721

**THE FEASIBILITY, PLANNING AND CONSTRUCTION OF PEATLAND TERTIARY TREATMENT SYSTEMS,** Williams and Works, Inc., Grand Rapids, MI.  
T. C. Williams.

In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 331-343, 1976.

**Descriptors:** \*Sewage treatment, \*Biological treatment, \*Wetlands, \*Michigan, \*Feasibility, Tertiary treatment, Land use, Economics, Aesthetics, \*Houghton Lake (Mich).

The 'feasibility' of adopting wetlands irrigation as an integral part of tertiary waste water treatment involves finding satisfactory answers to the concerns of the local project Authority, the service area population, regulatory agencies and scientific investigators. The concerns are for economy, effectiveness, environmental compatibility and aesthetics. Communication and publicity efforts have helped forge feelings of common interest and working together among the separate township governments in the Houghton Lake Area Sewer Authority. The Houghton Lake Wetlands Study is a landmark in tertiary treatment, and in the future may rival upland irrigation in feasibility for rural and resort communities. (See also W78-12707) (Stihler-Mass)  
W78-12722

**PROCESS FOR THE REDUCTION OF EFFLUENT COLOR FROM A CELLULOSIC PULP BLEACHING SEQUENCE,** Hooker Chemicals and Plastics Corp., Niagara Falls, NY. (Assignee).

R. J. Gall, and F. H. Thompson.  
U.S. Patent No. 4,081,317, 9 p, 11 tab, 3 ref; Official Gazette of the United States Patent Office, Vol 968, No 4, p 1442, March 28, 1978.

**Descriptors:** \*Patents, \*Waste water treatment, \*Industrial wastes, \*Color, Bleaching wastes, Pulp and paper industry, Cellulose, Chlorine, Hypochlorite.

A process for bleaching a cellulosic pulp is provided which comprises treating the pulp in aqueous suspension with at least one member selected from the group consisting of chlorine and chlorine dioxide to solubilize non-cellulosic material as-

sociated with the cellulosic pulp, and thereafter treating the pulp at a weight consistency of from 3 to 15% to hypochlorination with from about 0.5 to about 3.0% hypochlorite on a dry pulp weight basis at a temperature from about 75 to about 160°F., at a pH from about 6 to less than 9 for from 15 to 180 minutes. (Sinha-OEIS)  
W78-12775

**PURIFICATION OF WASTE WATER HIGH IN CARBOHYDRATES AND SIMULTANEOUS PRODUCTION OF HIGH PROTEIN FEED PRODUCT,** Bio-Kinetics Inc., San Rafael, CA. (Assignee).

J. R. Hulls, and D. M. Donofrio.  
U.S. Patent No. 4,081,367, 6 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 968, No 4, p 1456, March 28, 1978.

**Descriptors:** \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Water purification, Carbohydrates, Food processing industry, Yeasts, \*Aeration, Water reuse, Useful byproducts, Animal feed.

A method for purifying waste water high in carbohydrate and obtaining from it a high-protein feed product is described. The waste water is inoculated with yeast of the type that converts starch and sugars into more yeast. The pH is adjusted to desired levels, and then inoculated waste is circulated and recirculated in conjunction with air in amounts that enhance the growth rate of the yeast. The purified liquid waste is then separated from moist solids, and a large proportion of the moist solids is harvested as feed material, while a smaller proportion is taken for use in recycle. T. proportion to be recycled is sent to a treatment zone where the pH is lowered to approximately 3.5 and where antibiotics are added, the lowering of the pH and the antibiotics both serving to suppress a substantial portion of bacterial growth while enabling the yeast to grow. After a suitable dwell time, the treated material is used in the inoculating step as the inoculant. (Sinha-OEIS)  
W78-12779

**COMMON ION EFFECT TO ASSIST LM SEPARATION,** Exxon Research and Engineering Co., Linden, NJ. (Assignee).

N. N. E. Li, R. P. Cahn, and A. L. Shrier.  
U.S. Patent No. 4,081,369, 4 p, 1 tab, 3 ref; Official Gazette of the United States Patent Office, Vol 968, No 4, p 1457, March 28, 1978.

**Descriptors:** \*Patents, \*Waste water treatment, \*Separation techniques, \*Membrane processes, Water treatment, Solubility, Emulsions, Chemical precipitation, Aqueous solutions, Heavy metals, Liquid membrane processes.

The invention relates to an improvement in the liquid membrane process for removing soluble materials from solution. More specifically, soluble materials are removed from solution by contacting the solution with an emulsion, the external phase of which is immiscible with the solution and permeable to the soluble materials. The internal phase contains a reactant which reacts with the soluble material and converts the soluble material to a material which is insoluble and thus trapped in the internal phase. The improvement comprises maintaining the concentration of the reactant in the internal phase of the emulsion at a level at which the concentration of the soluble material in the internal phase of the emulsion is less than the concentration to which it is desirable. Preferably the solution is aqueous and the soluble material is a salt. For example, the concentration of fluoride ion in an aqueous solution is lowered to less than 6 ppm by contacting the solution with an emulsion containing a soluble calcium salt in the internal phase. The concentration of calcium in the internal phase is maintained at a level sufficient to provide a concentration of less than 6 ppm soluble fluoride ion in the internal phase. (Sinha - OEIS)

W78-12781

**LIQUID AERATION TO REDUCE BIOLOGICAL OXYGEN DEMAND,** Zink (John) Co., Tulsa, OK. (Assignee).

R. D. Reed.  
U.S. Patent No. 4,081,378, 7 p, 5 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 968, No 4, p 1459, March 28, 1978.

**Descriptors:** \*Patents, \*Waste water treatment, \*Water pollution treatment, Organic wastes, Aeration, Chemical oxygen demand, Bubbles, Equipment.

It is necessary for effluent streams to be processed for reduction in biological oxygen demand before they can be vented to waterways in order to avoid very serious pollution of the waterways. Air is bubbled upwardly through the liquid so that the oxygen of the air becomes available to the liquid at the surface of each bubble. Because the air is forced into the liquid at some depth, the bubbles are small. But as buoyancy forces the bubble to rise, the size of the bubbles increases with rise. Therefore, the greater the number of bubbles formed as air enters the liquid, the better the air-liquid contact, which result in greater oxygen delivery to the liquid within a fixed time period. A tank or vessel is provided into which liquid is supplied at a controlled rate and temperature, through a pipe at the base of the vessel. There is a horizontal dividing wall near the bottom of the vessel with narrow slots through which all of the water must pass in the form of vertical sheets of liquid. An air manifold is connected to tubes, pipes, or arms and small diameter holes, openings or orifices are drilled in the bottom surface of the arms. A column of liquid plus bubbles rises directly above each of the arms and moves toward the top of the vessel. A horizontal baffle plate is provided near the top of the vessel, which forces the liquid and air bubbles to pass through the space between the outer circumference of the baffle and the inner surface of the vessel. The water and air bubbles then move radially inward, the bubbles are disengaged from the thin sheet of water and the liquid is drained out the side of the vessel. (Sinha - OEIS)  
W78-12783

**METHOD OF PURIFICATION,** Agence Nationale de Valorisation de la Recherche, Neuilly-sur-Seine (France). (Assignee).  
E. Papirer, and J. Donnet.  
U.S. Patent No. 4,082,660, 5 p, 4 ref; Official Gazette of the United States Patent Office, Vol 969, No 1, p 268, April 4, 1978.

**Descriptors:** \*Patents, \*Water pollution treatment, \*Water quality control, \*Water purification, Oil pollution, Organic compounds, Industrial wastes, Separation techniques, Chemical reactions, Polymers, Hydrocarbons, Petroleum.

The invention is related to a method of purification of waters polluted by organic impurities such as hydrocarbons. The purification agent is constituted by an pulverulent solid on the surface of the constituent particles of which chains of polymers are fixed by grafting. This grafting of the polymer chains on the pulverulent mineral solid distinguishes the purification agent from the products which would be constituted by particles simply coated with polymer. The purification agents are constituted by pulverulent solids selected from the group formed by silica, the oxides of zinc, of titanium, of aluminum, as well as silicates, silicoaluminates and metallic carbonates. The polymers grafted to the surface of the constituent particles of the purification agent may be selected from the group which comprise double bonds, carbonyl groups or peroxide groups. The purification agents thus constituted are completely insoluble in aqueous media and very effective by reason of the large contact surface that they offer to the hydrocarbons which have to be extracted

from the polluted aqueous media. The insolubility of the purification agents enables them to be very easily recovered once the aqueous medium has been purified. (Sinha-OEIS)  
W78-12785

**LIQUID WASTE TREATMENT APPARATUS**, J. E. Prince, F. E. Terry, and W. H. Mullins. U.S. Patent No. 4,082,663, 4 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 969, April 4, 1978.

Descriptors: \*Patents, \*Waste water treatment, \*Industrial wastes, \*Water pollution treatment, Sewage treatment, Organic wastes, Aeration, Oxygen, Temperature, Equipment.

A self-contained extraction, aeration and return unit capable of intrusion into existing liquid circuits is provided. The unit can intrude either as a supplementing step, such as for boosting aeration rates in existing aerating vessels, or as a preliminary step either immediately before the remaining treatment steps or at a geographically remote point which permits action of the oxygen in the waste liquid while enroute to a treatment plant. The invention is not limited to use in the treatment of sewage but has application in any liquid circuit where aeration is required such as reducing mineral content of potable water and aquaculture applications. In addition to its use as an oxygenating aerator, the unit may be employed to infuse relatively cooler air into warm or hot waste liquid and thereby reduce the temperature of waste liquid. The preferred form of the invention includes an aspirator having an elongate, constant-area mixing chamber at and immediately downstream from the point at which the air is drawn into the liquid. (Sinha-OEIS)  
W78-12787

**SEPARATOR OF OIL AND WATER**, Barton Hydraulic Engineering Co. Ltd., Birmingham (England). (Assignee). For primary bibliographic entry see Field 5G.  
W78-12789

**REMOVAL OF HEAVY METAL IONS FROM AQUEOUS SOLUTIONS WITH INSOLUBLE CROSSLINKED-STARCH-XANTHATES**, Department of Agriculture, Washington, DC. Office of the Secretary. R. E. Wing, and W. M. Doane. U.S. Patent No. 4,083,783, 11 p, 2 fig, 14 tab, 3 ref; Official Gazette of the United States Patent Office, Vol 969, No. 2, p 636, April 11, 1978.

Descriptors: \*Patents, \*Waste water treatment, \*Chemical wastes, \*Industrial wastes, Water pollution treatment, Heavy metals, Separation techniques, Crosslinked-starch-xanthate.

Insoluble-starch-xanthates were prepared by xanthation of highly crosslinked-starches under various conditions. After isolation of the products by solvent dehydration, freeze drying, spray drying, or flash drying, their properties were determined. Products prepared using magnesium salt incorporation gave increased room temperature stability. Concentrations of heavy metal ions obtained in several industrial effluents were reduced to below the most stringent aqueous discharge limits. (Sinha-OEIS)  
W78-12801

**BIOLOGICAL TREATMENT PLANT FOR LIQUID SUSPENSIONS**, Degremont Societe Generale D'Epuration et D'Assainissement, Rueil Malmaison (France). (Assignee). J. Bernard, and M. Renaudin. U.S. Patent No. 4,083,785, 9 p, 6 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 969, No 2, p 937, April 11, 1978.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, Water quality control, \*Water pollution treatment, \*Biological treatment, Industrial wastes, Oxygenation, Aerobic conditions.

An improved plant arrangement for carrying out a biological process is provided which affords a more regular supply of oxygen to the various compartments or tanks of the plant, thus ensuring a better continuity in the oxygen contents of the liquor contained in the enclosures. A more regular operation of the plant in general is obtained, while reducing the oxygen consumption and finally improving considerably the power balance. The oxygen or oxygen-enriched air is caused to circulate through the oxidation tank or compartment in counter-current relationship to the liquor and recycled sludge, the oxygen being fed to the downstream tank while the venting to the atmosphere takes place in the upstream tank. This venting is directly subordinate to the oxygen content of the gaseous phase of the upstream tank where the oxygen demand and therefore the consumption of this valuable gas assume their highest values. The flow of oxygen-enriched air from the down-stream tank, where the demand and consumption are lower, is attended by an immediate and continuous increment or increase in the oxygen content of the gaseous phase of the upstream tank. With the arrangement it is thus possible to obtain a rapid response to any oxygen demand, as well as a regular and continuous oxygen supply throughout the plant. (Sinha-OEIS)  
W78-12802

**D-XYLOSE RECOVERY FROM HARDWOOD SULPHITE - LIQUOR USING ISOPROPANOL AZEOTROPE**. German Patent DS 1939-695. Issued July 13, 1978. Derwent German Patents Abstracts, Vol. A. No. 29, p 1, August, 1978.

Descriptors: \*Sulfite liquors, \*Pulp wastes, \*Pulp and paper industry, \*Patents, \*Separation techniques, Hardwood, Chemical precipitation, Crystallization, Waste water treatment, Industrial wastes.

A patent has been issued for a process to recover crystalline D-xylose from hardwood sulfite liquors. Under reduced pressure, the effluent is concentrated to a solids content of 40-55% at <60°C and extracted azeotropically by a 5:1 isopropanol-to-water mixture at the same temperature. The extract is further concentrated by removing the water and isopropanol, followed by separation with 6 liters isopropanol/kg concentrate at <60°C. The extract is cooled to 5°C and the precipitated impurities are filtered from the concentrate. The filtered material is concentrated, dissolved in a 95% ethanol solution, and recrystallized. (Lisk-FIRL)  
W78-12927

**REMOVAL OF MINERAL OIL AND HEAVY METAL IONS FROM EFFLUENT - BY FILTRATION THROUGH LAYERS OF WOOD SHAVINGS AND SULFONATED COAL TO IMPROVE PURITY**. Soviet Patent SU-569-546. Issued September 14, 1977. Derwent Soviet Inventions Illustrated, Vol. A. No. 27, p 6, August, 1978.

Descriptors: \*Oil wastes, \*Heavy metals, \*Filtration, \*Patents, \*Coals, Sawdust, Pine trees, Wood wastes, Filters, Absorption, Oil industry, Copper, Zinc, Design data, Waste water treatment, Saturation, Incineration, Industrial wastes.

A patent has been issued for a combined sawdust-sulfonated coal filter that absorbs mineral oil and heavy metal ions from oily effluent streams. The filter is packed with a 2:1 weight ratio of sawdust to sulfonated coal. In an example cited, 200 liters of industrial waste water bearing 280 mg/liter of mixed compressor and transformer oils, 15.0 mg

Cu/liter, and 18.5 mg Zn/liter were filtered through the pine shavings and sulfonated coal layers at a rate of 0.25 liters/min. The filter has an oil absorption capacity of 270 mg/g of media and becomes saturated after throughput of 200-fold of the filter volume in effluent. When the media reaches its saturation point, it is incinerated. Copper ions are reduced by 97.8% and zinc levels decreased by 97.3% on the filter. (Lisk-FIRL)  
W78-12929

**MIXED CULTURE INTERACTIONS IN CONTINUOUS CULTURE: STUDIES ON THE ROLE OF PHOTOSYNTHETIC BACTERIA IN WASTE WATER TREATMENT**. New South Wales Univ., Kensington (Australia). H. Sawada. PhD. Thesis, 1977.

Descriptors: \*Photosynthetic bacteria, \*Textiles, \*Antibiotics(Pesticides), \*Anaerobic bacteria, \*Biological treatment, Protein, Trace elements, Vitamins, Nutrient requirements, Competition, Biochemical oxygen demand, Waste water treatment, Industrial wastes.

The role of photosynthetic bacteria in the treatment of textile and antibiotic manufacturing waste water was evaluated in the presence of competition by heterotrophic bacteria. *Rhodospseudomonas capsulata*, a non-sulfur purple species, was used as the representative photosynthetic bacteria; *Klebsiella pneumonia*, a facultative anaerobic, was used as a representative heterotrophic bacteria. High BOD synthetic waste water and effluent from wool scour, abattoir, and antibiotic processing plants were employed as culture media. In mixed cultures sustained under anaerobic and illuminated conditions, glucose was converted by the heterotrophs to fatty acids which were then assimilated by the photosynthetic bacteria. The growth rates of photosynthetic bacteria increased in the presence of: a strong light source; a micro-aerobic environment; sources of vitamins, trace heavy metals, and some amino acids; and autolyzed heterotrophic bacteria. Low dilution rates also enhanced growth. The degradation of fatty acids was more efficient in a two-stage continuous mixed culture where autolysis of the heterotrophic bacteria stimulated waste degradation by *R. capsulata* in the second stage. In wool scour and abattoir effluent, the photosynthetic flora developed during the beginning phases of batch treatment. *R. capsulata* was more effective in the antibiotic effluent, where photosynthetic bacteria developed during the latter stages of treatment. The bacteria were considered a potential source of single cell protein. (Lisk-FIRL)  
W78-12931

**TREATMENT OF WASTE TREATMENT PLANT EFFLUENTS BY REVERSE OSMOSIS**, Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre; and Ontario Ministry of the Environment, Toronto. Pollution Control Branch. H. K. Johnston, and H. S. Lim. Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 84, 1978. 122 p, 33 fig, 14 ref, 29 tab, 4 append. 73-3-14 (Volume II).

Descriptors: \*Waste treatment, \*Waste water treatment, \*Reverse osmosis, \*Industrial plants, \*Industrial wastes, Pilot plants, Laboratory tests, Nutrient removal, Chemicals, Bacteria, Sewage treatment, Effluents, \*Flux levels, \*Cellulose acetate membranes.

The suitability of reverse osmosis as an advanced wastewater treatment process was investigated in laboratory and pilot plant situations. The effectiveness of this technique for the removal of nutrients, bacteria, and various chemical constituents was examined. Laboratory test cells and eight tubular modules were employed to treat nutrient solutions, various secondary effluents,



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

nutrient spiked sewage and raw sewage. Cellulose acetate membranes with 75 percent and 90 percent salt rejection were employed. Optimum operating conditions for the pilot plant were determined and chemical cleaning techniques were applied to restore permeate flux levels. Flux was adversely affected by membrane fouling. However, results indicated high, yet stable, removals for most constituents. Although not yet economically competitive, in many cases, reverse osmosis is a potentially advantageous wastewater treatment technique. (WATDOC)  
W78-12947

#### REMOVAL OF PERSISTENT CONTAMINANTS FROM MUNICIPAL EFFLUENTS BY REVERSE OSMOSIS

Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre; and Ontario Ministry of the Environment, Toronto. Pollution Control Branch.  
H. K. Johnston, and H. S. Lim.

Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 85, 1978. 66 p, 6 fig, 10 ref, 7 tab, 2 append. 73-3-14 (Volume III).

Descriptors: \*Heavy metals, \*Pesticide removal, \*Water pollution sources, \*Separation techniques, \*Reverse osmosis, Municipal wastes, Effluents, Toxins, Dissolved solids, Suspended solids, Sorption.

The effectiveness of the reverse osmosis process in removing specific toxic substances from municipal effluents was studied. The toxic substances considered were: arsenic, selenium, cyanide (simple and complex salts), nitrotriacetic acids (NTA), phenols, aldrin, DDT, chlordane, endrin, melathion, and parathion. Experiments were conducted in the laboratory and in a specially equipped mobile pilot plant. Data on removal efficiencies are presented along with reverse osmosis (RO) system permeation rates and variations in those rates with time. Membrane fouling problems and cleaning methods were examined and are reported on. Chlorinated hydrocarbon and organic phosphate pesticides are almost completely removed by RO while the heavy metal removal rate was consistently greater than 95 percent. The removal rates for other substances examined such as: complex cyanide, NTA, selenium, arsenic and phenols, varied between 43 percent and 90 percent. (WATDOC)  
W78-12948

#### SUMMARY REPORT ON PHOSPHORUS REMOVAL

Ontario Ministry of the Environment, Toronto.  
J. D. Archer.  
Canada-Ontario Agreement on Great Lakes Water Quality, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, Research Report No. 83, 1978. 82 p, 6 fig, 5 ref, 6 tab, 3 append. 75-1-42.

Descriptors: \*Nutrient removal, \*Phosphorus, \*Waste water treatment, \*Treatment facilities, \*Desalination processes, Chemical reactions, Testing, Sludge disposal, Effluents, Operating costs, Capital costs, \*Jar testing, \*Full-scale testing, Phosphorus concentrations, Treatability studies, Chemical costs, Lower Great Lakes Basin.

This report covers the findings of the phosphorus removal studies carried out on wastewater treatment plants under the Canada-Ontario Agreement on Great Lakes Water Quality. Phosphorus removal can be achieved at any existing wastewater treatment plant with the addition of iron salts, aluminum salts or lime. Since essentially any of these three chemicals can adequately remove phosphorus at a wastewater treatment plant, the purpose of the treatability studies described in this report was to determine which chemical would most economically remove the phosphorus to the required level, yet be totally compatible with the

existing treatment process. Information was collected on the phosphorus removal facilities installed at wastewater treatment plants, to compare the actual performance of these facilities with the predictions that were made from treatability studies. The two-stage treatment study (jar and full-scale testing) was found to be the most reliable method of selecting the appropriate chemical and dosage rate. Operational problems, and capital and operating costs are presented and discussed. (WATDOC)  
W78-12950

#### DEWATERING ALTERNATIVES FOR POTATO WASTES, A PRELIMINARY STUDY

Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.  
H. W. Campbell, and J. W. Pike.  
Technology Development Report EPS 4-WP-78-6, August, 1978, 33 p, 11 fig, 12 ref, 8 tab, append.

Descriptors: \*Potatoes, \*Solid wastes, \*Industrial wastes, \*Industrial plants, \*Dewatering, Waste treatment, Drying, Chemicals, Fermentation, Landfills, Feeds, Model studies.

Potato processing plants generate large quantities of solid waste from both process and waste treatment sources. One of the major constituents is the waste from the lye peel process. This waste has a high pH (approximately or less than 12.5), a relatively low solids content (approximately or less than 12 percent) and, due to its gelatinous consistency, is extremely difficult to dewater. A study was initiated in 1975 to identify conditioning methods which would improve the dewaterability of this waste, and to evaluate those dewatering processes which were capable of producing a material suitable for either cattle feed or disposal as a solid material in a landfill site. The experimental program was carried out in two phases. The first phase consisted of bench scale experiments at the Wastewater Technology Centre (WTC), Burlington, Ontario to identify potential conditioning chemicals, and to qualitatively evaluate the feasibility of thermal drying. The second phase consisted of experiments on a pilot scale steam heated drum dryer, carried out under contract by the Research and Productivity Council, Fredericton, New Brunswick. Although many conditioning chemicals were evaluated, only the following achieved any degree of success: a combination of ferric chloride and lime; and methanol. Additions of ferric chloride and lime produced only marginal thickening at relatively high chemical additions (20 percent ferric chloride, 20 percent lime). The addition of methanol in a 1 to 1 volume ratio resulted in a sludge which could be readily dewatered. Cake solids exceeding 30 percent were achieved with the lye peel waste from both the bench centrifuge test and filter leaf test. (WATDOC)  
W78-12951

### 5E. Ultimate Disposal of Wastes

#### NUMERICAL MODELLING OF LIQUID WASTE INJECTION INTO POROUS MEDIA SATURATED WITH DENSITY-STRATIFIED FLUID: A PROGRESS REPORT

Hawaii Univ., Honolulu. Water Resources Research Center.  
For primary bibliographic entry see Field 5B.  
W78-12102

#### INTERACTION OF ROOT GROWTH AND REFUSE DECOMPOSITION IN A SANITARY LANDFILL

Alabama Agricultural Experiment Station, Auburn.  
For primary bibliographic entry see Field 5G.  
W78-12110

#### THE CULTURE OF CRAYFISH FOR WASTE RECYCLING AND HUMAN CONSUMPTION

California Univ., Davis. Dept. of Animal Science; and California Univ., Davis. Div. of Environmental Studies.

For primary bibliographic entry see Field 5G.

W78-12114

#### WATERCRESS-CRAYFISH POLY-CULTURE AS AN ECONOMIC MEANS OF STRIPPING NUTRIENTS FROM ENRICHED WATERS

California Univ., Davis. Div. of Environmental Studies; and California Univ., Davis. Dept. of Animal Science.

For primary bibliographic entry see Field 5G.

W78-12115

#### EFFECT OF VEGETATION ON LANDFILL STABILIZATION

Auburn Univ., AL. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5G.

W78-12136

#### OCEAN DISPOSAL IN THE MID-ATLANTIC BIGHT

Environmental Protection Agency, Philadelphia, PA.

W. C. Muir, G. M. Horwitz, and G. D. Pence.

In: Oceans '78, 'The Ocean Challenge', Fourth Annual Combined Conference, Marine Technology Society and Institute of Electrical and Electronics Engineers, held in Washington, DC on 6-8 September 1978. p 456-461, 3 fig, 2 tab, 11 ref.

Descriptors: \*Waste disposal, \*Water pollution sources, Municipal wastes, Industrial wastes, Environmental effects, Outer Continental Shelf, Mid-Atlantic Bight, Ocean dumping.

With the passage of the Marine Protection, Research, and Sanctuaries Act of 1972, the U.S. Environmental Protection Agency has been given the lead role in the protection of the nation's oceans from the disposal of toxic pollutants. Through the establishment of a permit program, the U.S. EPA's Middle Atlantic Region III has brought the indiscriminate disposal of municipal and industrial wastes under control. The goal is to eliminate ocean disposal of harmful waste by January, 1981 through the development of sound, reasonable and environmentally acceptable land based alternatives. Until that goal is attained, an intensive monitoring program has been established to assess the fate and effects of all pollutants dumped into the Region's waters. (Sinha-OEIS)  
W78-12176

#### WET AIR OXIDATION: EFFECT ON SLUDGE COMPOSITION

Purdue Univ., Lafayette, IN. Dept. of Agronomy.  
L. E. Sommers, and E. H. Curtis.  
Journal Water Pollution Control Federation, Vol. 49, No. 11, November 1977, p 2219-2225. 2 fig, 4 tab, 6 ref. OWRT A-045-IND(3).

Descriptors: \*Oxidation, \*Waste disposal, Metals, Nutrients, Sludges, Sludge disposal, Sludge treatment, Waste treatment, Wet-air oxidation, Land disposal.

Wastewater sludge samples were obtained from waste treatment streams in two wastewater treatment before and after wet-air oxidation. Wet-air oxidation resulted in a 10 to 20 percent reduction in volatile solids. Concurrently, total N levels in the sludges decreased by >50 percent while P, Cu, Zn, Ni, Cd, and Pb concentrations either increased or remained unchanged. From the standpoint of applying wastewater sludge to agricultural land, inclusion of a wet-air oxidation unit in a treatment plant will decrease the desirability of using sludge as a fertilizer material.  
W78-12269

**PROTRACTED RECHARGE OF TREATED SEWAGE INTO SAND: PART II - TRACING THE FLOW OF CONTAMINATED GROUND WATER WITH A RESISTIVITY SURVEY.**  
Rensselaer Polytechnic Inst., Troy, NY.  
For primary bibliographic entry see Field 5D.  
W78-12305

**PROTRACTED RECHARGE OF TREATED SEWAGE INTO SAND: PART I - QUALITY CHANGES IN VERTICAL TRANSPORT THROUGH THE SAND.**  
Rensselaer Polytechnic Inst., Troy, NY.  
For primary bibliographic entry see Field 5D.  
W78-12306

**REUSE FOR SURVIVAL.**  
E. Adler.  
Saccap Action News, Vol. 3, No. 1, p 25-28, 1977.

Descriptors: \*Solid wastes, \*Resources recovery, Soil erosion, \*Industrial wastes, Mine wastes, Municipal wastes, Sewage sludge, \*Waste reuse, Waste composition, \*Waste disposal, Sanitary landfills, Incineration, Pyrolysis, South Africa.

Problems are reviewed of recovery and reuse of re-usable waste products and ways and means of disposing of such wastes as are demand irrecoverable. The wastage of natural resources is discussed, of which soil erosion is one of the most important aspects. Industrial and mining wastes are looked at as well as municipal wastes and sewage wastes. Suggestions as to the possible use of organic wastes as composts are given. (So Afr Water Info Ctr)  
W78-12405

**LET'S TALK RUBBISH, PART 7, DISPOSAL OF OLD TYRES.**  
Municipal Engineer, Vol. 8, No. 1, p 35-37, 1977.

Descriptors: Tyres, Rubber wastes, \*Solid wastes utilization, \*Landfills, \*Waste disposal, Pyrolysis, Combustion, Costs, Economics, Recycling, Reclamation, Furnaces, Embankments, \*South Africa.

Because of the fact that it is uneconomical to reclaim and re-use old tyres in the tyre making industry, and not withstanding the fact that about 20% of the tyre market belongs to retreads, all of the two hundred million new tyres produced in the USA thirty million in the UK and six million in S.A. have ultimately to be disposed of. Various ways of disposing of old tyres are discussed. A very small percentage of old tyres are reclaimed for production of new tyres while even a smaller percentage are used as scrap rubber for the production of matting, non skid additive to road surfaces etc. Research work is being done on a thermal process of distillation to produce gasses, oils and acids but it is doubtful if such a plant would be economically viable. Various incineration processes are discussed as well as the use of old tyres using the sidewalls as re-inforcement in earth embankments alongside roads enabling side slopes of embankments to be increased effecting large savings in construction costs. (So Afr Water Info Ctr)  
W78-12429

**HIGH DENSITY BALING.**  
Municipal Engineer, Vol 7, No 5, p 80-81, 1976.

Descriptors: \*Waste disposal, \*Waste baling, Landfills, Environmental aspects, Metals removal, Waste size reduction, Operating costs, Waste shredding, Waste utilization, Solid wastes, \*South Africa.

The use is discussed of high density baling of refuse procedures to replace land reclamation as a method of disposal. New installations in Glasgow and seeds are discussed but the author comes to

the conclusion that although the principle of baling, to achieve volume reduction, was sound, the complexity of the equipment and the buildings would make it financially unacceptable in South Africa. High density baling in Japan, where bales are coated with about 100 mm of concrete and then used as building blocks, is also discussed. (So Afr Water Info Ctr).  
W78-12441

**LET'S TALK RUBBISH, PART 4: REFUSE COLLECTION.**  
Municipal Engineer, Vol 7, No 3, p 69-72, 1976.

Descriptors: \*Wastes, Municipal solid wastes, Collection systems, \*Wastes processing, Waste sorting, Plastics, Polythene containers, Drums, Waste compacting, \*South Africa.

The quiet revolution that has taken place during the past five years or so in refuse collection is described. Most municipalities now have regulations empowering them to stipulate both size and type of container which they approve for the storage of domestic or trade refuse. First the galvanized metal bin, then the high-density polythene bin after that the two ply paper sack and lately, the polythene sacks for refuse storage. Also described in the article are compaction vehicles in use today. (So Afr Water Info Ctr)  
W78-12443

**ASEA REDUCES NUCLEAR WASTE IN SWEDEN.**  
Electrical Engineer, Johannesburg, No 4, p 39-40, 1977.

Descriptors: \*Sweden, \*Nuclear reactors, \*Nuclear wastes, Radioactive wastes, Ion exchange, Strontium, Leaching, Nuclear fuel reprocessing, Radiation, Calcination, Vitrification, Waste disposal, Hot isostatic pressing.

ASEA the worldwide manufacturer of electrical and mechanical equipment with headquarters in Vasteras, Sweden, is working on the development of a method using hot isostatic pressing for the safe containment and storage of nuclear wastes. The waste is compacted together with suitable materials to form dense and solid bodies, which have a very high leach resistance to the ground-water and a greater mechanical strength than, for example granite. ASEA's method may help the utilities to meet the laws and regulations covering nuclear waste management and the final disposal of such waste. (So Afr Water Info Ctr)  
W78-12452

**OPERATING THE FRANKLIN WASTE RECOVERY AND COMPLEMENTING WASTE WATER TREATMENT PLANT-RECLAIMING PAPER FIBRES, METALS AND GLASS.**  
B. F. Eichholz.  
Municipal Engineer, Vol 8, No 4, p 35-37, 39, 1977.  
2 fig.

Descriptors: \*Waste recovery, \*Solid wastes, Waste paper, \*Wastes utilization, Metals, Glass, Regional treatment plants, Sewage treatment, Sewage sludge, Burning, Sewage effluents, Fly ash, Settling, Costs, \*Waste disposal, Ohio.

A resume of the operation of the Franklin Ohio, USA, Solid Waste Disposal and Reclaim Facility. The heart of the facility is the Hydrasposal process, which is actually similar to systems used in hundreds of paper mills. All incoming refuse is fed by conveyor into the hydropalmer and there reduced to a pulp. At the time of the original design, the scope of the system began to expand. Engineers reasoned that if 50% of municipal solid waste is paper, why cannot the paper fibres be reclaimed. And accordingly the fibre reclaim system was added. This thought also posed the question: Why not also reclaim metals and glass.

And accordingly the system was broadened to extract metals and glass. The possibility of extraction of the glass attracted the attention of the Glass Container Manufacturers Institute and now, the City and the Glass Container Manufacturers Institute, assisted by a Demonstration Grant from the Solid Waste Management Office, are adding a glass sorter which separates the aluminium from the glass and then sorts the glass into three colours: clear, amber and green. (So Afr Water Info Ctr)  
W78-12467

**LET'S TALK RUBBISH - PART 10.**  
Municipal Engineer, Vol 8, No 4, p 69, 71, 1977.

Descriptors: \*Solid wastes, \*Waste disposal, \*Recycling, \*Wastes utilization, Resources recovery, Landfill, Leachates, Industrial wastes, Wastes to energy, Baling, \*South Africa.

Discusses the papers presented at the 79th Conference of the institute of solid wastes management at Torbay, England. Titles of the papers discussed are: (1) Re-Use of Waste; (2) Attenuation and Control of Landfill Leachates; (3) Maximising Human Resources in the Present financial climate; (4) The Impact of Site Licensing on the Future of Industrial Waste Disposal; (5) Energy from Waste and its Potential Use as a Fuel; (6) Trends in Refuse Collection; (7) High Density Baling as a Solution to Solid Waste Disposal. (So Afr Water Info Ctr)  
W78-12470

**THE BASIC DESIGN OF JOHANNESBURG'S DIEPSLOOT OUTFALL SEWER BRIDGE STRUCTURES, WITH SPECIAL REFERENCE TO MAJOR THERMAL MOVEMENTS.**  
A. J. Hay.  
Municipal Administration and Engineering, (Johannesburg) Vol 42, No 504, p 7-8, 10, 12-14, 1977, 2 tab, 5 fig.

Descriptors: \*Design criteria, \*Outfall sewers, Arch bridges, Engineering structures, Geology, Creep, Shrinkage, Deformation, Elastic properties, Pipelines, Bridge piers, Expansion joints, Thermal expansion, Reinforced concrete, South Africa.

Discussion is presented the associated geology and design criteria, and gives a description of the Diepsloot outfall sewer arch bridges at Johannesburg. It also covers movements and survey control during construction, in order to verify design criteria and hence to make adjustments to fit the actual conditions in practice. Vertical and horizontal movements caused by thermal effects, creep, shrinkage, elastic deformations and pipe and pedestal movements related to the basic structure are also covered. The paper is of extreme importance to the municipal engineer. (So Afr Water Info Ctr)  
W78-12482

**CRACKING ON THE EXPOSED CONCRETE PIPELINE OF THE DIEPSLOOT OUTFALL SEWER, JOHANNESBURG: FIELD INVESTIGATIONS AND INTERPRETATIONS.**  
For primary bibliographic entry see Field 8F.  
W78-12486

**DESIGN OF FLOCCULATION SYSTEMS FROM BATCH TEST DATA.**  
Cape Town Univ. (South Africa).  
For primary bibliographic entry see Field 5D.  
W78-12489

**SLUDGE, THE AWKWARD CINDERELLA.**  
J. Halliday.  
Imiesa, Johannesburg, Vol 2, No 10, p 24-27, 1977.  
2 fig.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5E—Ultimate Disposal Of Wastes

**Descriptors:** \*Waste water treatment, \*Sludge treatment, \*Biological filtration, Activated sludge process, Sludge settling, Centrifugation, Flocculation aids, Sludge incineration, South Africa.

The difficulty with sewage is the solids it contains. Not that the solids are in such vast quantities but rather that separating the solids from the liquids is half the task of sewage purification. The other half is treating the solids. Primary sludge volume could be approximately 1% of the main flow in domestic sewage and the mass of dried solids could be of the order of 0.05% of the original flow. However, depending upon what was done with this sludge the cost of its treatment could be 30-50% of the total cost of the wastewater treatment operation. The author emphasized the influence, the type of liquid phase treatment may have on the subsequent sludge handling. (So Afr Water Info Ctr) W78-12503

#### THE WASTES ENDURE,

For primary bibliographic entry see Field 5B. W78-12564

#### FLOW OF KAOLINITE AND SEWAGE-SLUDGE SUSPENSIONS IN SAND-SILT POROUS MEDIA,

Purdue Univ., Lafayette, IN. Water Resources Research Center. For primary bibliographic entry see Field 5B. W78-12606

#### A MULTILEVEL DEVICE FOR GROUND-WATER SAMPLING AND PIEZOMETRIC MONITORING,

Department of the Environment, Ottawa (Ontario). Hydrology Research Div. For primary bibliographic entry see Field 7B. W78-12636

#### FRESHWATER WETLANDS AND SEWAGE EFFLUENT DISPOSAL: PROCEEDINGS OF A NATIONAL SYMPOSIUM HELD AT THE UNIVERSITY OF MICHIGAN.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 305. Price codes: A15 in paper copy, A01 in microfiche. Symposium held on May 10-11, 1976. Report NSF/RA-760251. Michigan University, Ann Arbor, 1976. 343 p.

**Descriptors:** \*Wetlands, \*Water pollution, \*Sewage treatment, \*Conferences, \*Sewage disposal, \*Waste water disposal, Marshes, Sewage, Sewage effluents, Waste water treatment, Sewage effluent disposal.

The symposium was held to discuss the feasibility of using freshwater wetland ecosystems to remove certain chemicals from secondarily treated waste water before they enter lakes, streams, and groundwaters. The papers provide a survey of the state-of-the-art and the work that needs to be done. Areas of discussion are: (1) Hydrology: fate of waters beyond the wetlands, loading rate, flow rate within the wetland; (2) Nutrient dynamics and accumulation: efficiency of treatment, mechanism of nutrient removal from waste water, loading rate; (3) Environmental impacts: changes in species composition, habitat protection, health; (4) Legal aspects: enabling policy and legislation; (5) Economic considerations: savings in construction cost, benefits associated with protection of environmental quality; (6) Land use: compatible with other traditional uses of wetlands, policies associated with state and federal wetlands; and (7) Design considerations: artificial or natural wetlands, method of effluent discharge, schedule of pumping, determination of discharge rate. (See W78-12708 thru W78-12722) (Steiner-Mass) W78-12707

#### SURFACE HYDROLOGY OF PEATLANDS,

Michigan Univ., Ann Arbor. Dept. of Chemical Engineering. For primary bibliographic entry see Field 2H. W78-12708

#### DISSOLVED NUTRIENTS IN A PEATLAND NEAR HOUGHTON LAKE, MICHIGAN,

Utah State Univ., Logan. Dept. of Wildlife Science. For primary bibliographic entry see Field 5C. W78-12709

#### PRODUCTIVITY AND NUTRIENT CONTENT OF EMERGENT MACROPHYTES IN TWO WISCONSIN MARSHES,

Wisconsin Univ.-Milwaukee. Dept. of Botany. For primary bibliographic entry see Field 5C. W78-12710

#### PLANT GROWTH, NUTRIENT ACCUMULATION AND DECOMPOSITION IN A CENTRAL MICHIGAN PEATLAND USED FOR EFFLUENT TREATMENT,

Michigan Univ., Ann Arbor. School of Natural Resources. For primary bibliographic entry see Field 5C. W78-12711

#### SEWAGE SPRAY IRRIGATION IN A DELAWARE RIVER FRESHWATER TIDAL MARSH,

Rider Coll., Trenton, NJ. Dept. of Biology. D. F. Whigham, and R. L. Simpson. In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 119-144, 1976. 8 fig, 2 tab, 34 ref.

**Descriptors:** \*Sewage effluents, \*Waste water, \*Tidal marshes, \*Delaware, \*Biological treatment, Wetlands, Freshwater marshes, Coastal marshes, Nitrogen, Phosphorus, Nutrients, Rooted aquatic plants.

Populations of most perennial species along with wild rice and waterhemp were apparently not affected during the first year of sewage spray irrigation. Two dominant annual species, touch-me-not and bur marigold, were sensitive to the chlorinated effluent. A third annual, halberd tearthumb, increased in importance in all non-control enclosures. There was a general depression in the height of the upper canopy. During the summer months, nutrient concentrations tended to be lower in the drainage channels than the remainder of the marsh. This pattern is more variable in the fall, especially for nitrate nitrogen. It appears that vascular plants act as sinks for nutrients during the summer months and release nutrients during the fall and winter. (See also W78-12707) (Stibler-Mass) W78-12712

#### EFFECTS OF SEWAGE EFFLUENT ON ECOSYSTEM DYNAMICS IN CYPRESS DOMES,

Florida Univ., Gainesville. Center for Wetlands. For primary bibliographic entry see Field 5C. W78-12714

#### MARSH/POND SEWAGE TREATMENT PLANTS,

Brookhaven National Lab., Upton, NY. Dept. of Applied Science. For primary bibliographic entry see Field 5D. W78-12715

#### ARTIFICIAL AND NATURAL MARSHES AS WASTEWATER TREATMENT SYSTEMS IN WISCONSIN,

For primary bibliographic entry see Field 5D. W78-12716

#### MINNESOTA'S PEAT RESOURCES: THEIR CHARACTERISTICS AND USE IN SEWAGE TREATMENT, AGRICULTURE AND ENERGY,

Minnesota Univ., St. Paul. Dept. of Soil Science. For primary bibliographic entry see Field 5D. W78-12717

#### TREATMENT OF SECONDARY EFFLUENT USING A PEAT BED,

Forest Service (USDA), Milwaukee, WI. For primary bibliographic entry see Field 5D. W78-12718

#### VIRAL ASPECTS OF WETLAND DISPOSAL OF EFFLUENT,

Epidemiology Research Center, Tampa, FL. For primary bibliographic entry see Field 5D. W78-12720

#### RECOVERY OF NUTRIENTS FROM PEATLANDS USED FOR TERTIARY TREATMENT,

Michigan Univ., Ann Arbor. Wetlands Ecosystem Research Group. For primary bibliographic entry see Field 5D. W78-12721

#### THE FEASIBILITY, PLANNING AND CONSTRUCTION OF PEATLAND TERTIARY TREATMENT SYSTEMS,

Williams and Works, Inc., Grand Rapids, MI. For primary bibliographic entry see Field 5D. W78-12722

#### THE EFFECTS OF THE OCEAN DISPOSAL OF MUNICIPAL WASTES.

Southern California Coastal Water Research Project, El Segundo. For primary bibliographic entry see Field 5C. W78-12820

#### A NEW CAPACITOR FLUID - A CASE STUDY IN PRODUCT STEWARDSHIP,

Dow Chemical Co., Midland, MI. For primary bibliographic entry see Field 5A. W78-12969

#### EVALUATION OF THE SIGNIFICANCE OF WATERWAY SEDIMENT-ASSOCIATED CONTAMINANTS ON WATER QUALITY AT THE DREDGED MATERIAL DISPOSAL SITE,

Texas Univ. at Dallas, Richardson. For primary bibliographic entry see Field 5A. W78-12981

### 5F. Water Treatment and Quality Alteration

#### PERMISSIBLE CONTENT OF THE FLOCCULATION AGENT POLYOXYETHYLENE IN BODIES OF WATER (IN RUSSIAN),

Novosibirsk Sanitary Research Inst. For primary bibliographic entry see Field 5G. W78-12292

#### HYGIENIC ASSESSMENT OF AN ANTICORROSION HERMETIC AH-4 USED IN A HOT WATER SUPPLY SYSTEM (IN RUSSIAN),

Nauchno-Issledovatel'skii Inst. Gigeny, Moscow. For primary bibliographic entry see Field 5A. W78-12295



# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Water Treatment and Quality Alteration—Group 5F

**FLOCCULANTS AND WATER TREATMENT**,  
J. R. Hoffman.  
Municipal Engineer, Vol. 7, No. 5, p 69-72, 1976. 2 fig., 1 tab.

Descriptors: \*Flocculants, \*Water treatment, \*Coagulants, Water purification plants, Potable water, Polyelectrolytes, Decolourization, Suspended solids removal, Colloidal flotation, Turbidity, Hydrogen ion concentration, Ferric chloride, South Africa.

A short description is given of the basic mechanisms of flocculation of turbid water with metal-salt coagulants and poly-electrolytes. The terms co-agulation and flocculation are explained and the influence of primary flocculants like aluminum sulphate and ferric chloride on unbuffered and buffered waters are described. A short review, regarding the properties and uses of poly-electrolytes, as well as comparative prices, are also given. (So Afr Water Info Ctr)  
W78-12390

**OBSERVATIONS ON THE DIAGNOSIS AND TREATMENT OF SCHISTOSOMIASIS IN AN ENDEMIC AREA**,  
Rhodesia Univ., Salisbury.  
For primary bibliographic entry see Field 5G.  
W78-12395

**PARASITIC INFECTIONS IN FLACK CHILDREN IN AN ENDEMIC SCHISTOSOMIASIS AREA IN NATAL**,  
South African Medical Research Council, Potchefstroom.  
For primary bibliographic entry see Field 5B.  
W78-12396

**CHLORINATION A CENTURY OF DISINFECTION**,  
Building and Construction, (Johannesburg), Vol. June 1976, p 35.

Descriptors: \*Chlorination, \*Disinfection, \*Water treatment, Operators, Chlorine, Calcium hypochlorite, Lithium hypochlorite, South Africa.

A brief review is given of chlorination for the disinfection of water during water treatment and goes on to explain the various chlorination processes, the chlorine values of commercial chlorine products and how chlorine works in the disinfection process. (So Afr Water Info Ctr)  
W78-12397

**RECYCLING AND DISPOSAL OF PLASTICS WASTE IN SOUTH AFRICA**,  
Council for Scientific and Industrial Research, Johannesburg (South Africa).  
For primary bibliographic entry see Field 5D.  
W78-12399

**DOSE FINDING TRIALS OF ORAL OXAMINQUINE IN RHODESIA**,  
Blair Research Lab., Salisbury (Rhodesia).  
V. D. Clarke, D. M. Blair, M. C. Weber, and P. A. Garnett.  
South African Medical Journal (Cape Town), Vol. 50, No. 46, p 1867-1871, 1976.

Descriptors: \*Waterborne diseases, Public health, Bilharzia, Dosage, Chemotherapy, Molluscicides, \*Human parasites, Schistosoma haematobium, Schistosoma, Oxamniquine, \*Rhodesia, Southern Africa.

Oral oxamniquine at a total dose of 60 mg/kg (given in 4 equal doses morning and evening over 2 days, after food) is an efficient and apparently very safe drug for the treatment of Schistosoma mansoni infections. Lower doses, or shorter schedules of treatment, are less efficient. The drug

has little or no effect on S. Haematobium infections. Side-effects are mild and infrequent. (So Afr Water Info Ctr)  
W78-12408

**POWER STATION EFFLUENT CONTROL AND THE REUSE OF ASH WATER FOR COOLING WATER TREATMENT**,  
W. N. Van Eeden.  
Energy (Braamfontein), p 21-27, June 1977.

Descriptors: \*Thermal powerplants, Closed system, \*Cooling water, Ash, Process water reuse, Pollution abatement, Effluents, Blowdown, Hydraulic transportation, Cost reduction, \*Thermal pollution, Escrow, \*South Africa.

Power Station effluents, e.g. concentrated cooling water blowdown, regeneration effluents from demineralisation plant and sewage effluents plus a large quantity of high pH water used in the hydraulic transportation of pulverised fuel ash had a serious river pollution potential. A method and circuit was devised utilizing the available lime in the ash water to clarify, dealkalize and soften the cooling water, on a by-pass system. By precipitating the limiting constituents in the cooling water, higher concentrations with reduced water consumption were made possible. The water circuit was completely closed with no effluent outlet to a water course. This resulted in a water saving but the saving in water treatment chemicals amounted to R60 000 per annum at this power station. (So Afr Water Info Ctr)  
W78-12417

**MODERN WATER RECLAMATION PLANT IN WINDHOEK**,  
For primary bibliographic entry see Field 5D.  
W78-12428

**WATER FOR THE FRIENDLY CITY**,  
Prospect, Vol 15, No 2, p 14-17, 1976.

Descriptors: \*Water supply, Aluminium sulphate, Water treatment, Purification, Pipelines, Reservoirs, Decolourization, Port Elizabeth, Churchill dam, Kromme River, Loerie dam, Paul Sauer dam, Gamtoos river, Eastern Cape, \*South Africa.

The two water purification works which supplies Port Elizabeth are described. Water from the various dams supplying the city has a brown colour emanating from the natural environment. Aluminium sulphate plays an important part in the removal of this colour. The article goes on to describe the benefits derived from receiving supplies of aluminium sulphate by containerised transport. (So Afr Water Info Ctr)  
W78-12456

**THICKENING OF BROWN WATER SLUDGES BY DISSOLVED-AIR (PRESSURE) FLOTATION**,  
Cape Town Univ. (South Africa).  
For primary bibliographic entry see Field 5D.  
W78-12492

**SOME PHYSICAL AND ECONOMIC ASPECTS OF OPTIMIZATION OF THE DEGREE OF WASTE WATER AND WATER TREATMENT**,  
Technical Univ. of Warsaw (Poland). Inst. of Water Supply and Hydrotechnics.  
For primary bibliographic entry see Field 5D.  
W78-12547

**WATER RESOURCES AND HEALTH PROBLEMS IN DEVELOPING COUNTRIES (IN FRENCH)**,  
Paris-7 Univ. (France). Dept. of Parasitology.  
A. Coumbara.  
Acta Trop 34(3), p 229-248, 1977.

Descriptors: Human diseases, Infectious diseases, Transmission(Diseases), \*Developing countries, \*Public health.

The rapidly increasing use of water for agricultural and hydroelectric development in developing countries is causing serious (human) health problems. These can be divided into 2 categories; the (infectious) diseases whose transmission depends on water, and the changes in the life style of the population. The principal health problems are briefly reviewed and the principles to be followed in solving them, and the reasons of the success or failure of health programs are analyzed. Among the topics considered are development vs. health, the collaboration of health service personnel with the rest of the personnel participating in water development schemes, the necessity of ensuring a multidisciplinary approach to the solutions of these health problems, the necessity of integration of the public health component within the administrative and budgetary levels and the coordination of public health measures with the development of project from the planning phase through the completion and maintenance phases, the purely medical aspects of the health problems involved appeared as being of secondary importance. Common sense and the use of simple, cheap methods adapted to the local conditions, and applied focally, provide better solutions than the sophisticated, more general and expensive approaches. The time and budget accorded for surveys and research, usually excessive, should be limited. It is necessary to adhere to a disciplined use of water. Ambitions and utopian dreams and strategies of disease eradication should, in general, give way to more limited, but accessible objectives, whose attainment would lead to a decrease of the clinical and socioeconomic gravity of the health problems to a reasonable level.—Copyright 1978, Biological Abstracts, Inc.  
W78-12625

**AN EPIDEMIOLOGICAL SURVEY ON THE CLONCHIASIS IN THE HAN RIVER SIDES (IN KOREA)**,  
Hanyang Univ., Seoul (Republic of Korea). School of Medicine.  
For primary bibliographic entry see Field 5C.  
W78-12682

**PORTABLE WATER DISTILLATION APPARATUS**,  
G. Weiss.  
U.S. Patent No. 4,081,331, 5 p, 3 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 968, No 4, p 1446, March 28, 1978.

Descriptors: \*Patents, \*Water purification, \*Water treatment, \*Water quality control, \*Distillation, Condensation, Evaporation, Condensers, Evaporators.

A distillation apparatus has an evaporator for vaporizing liquid to be distilled, a vertical up-and-down flowing condenser connected with the evaporator for condensing vaporized liquid received from the evaporator, and a heater for applying heat to and vaporizing fluid in the evaporator. The condenser feeds liquid into the evaporator to maintain a constant level of liquid in the evaporator at the highest normal point of flow of liquid in the condenser. The vapor travels downward through the condenser becoming condensed at the bottom where a distilled water output is provided for discharge of the distillate. This apparatus is portable and capable of quick connection and disconnection to available water supplies. It is especially suitable for use where tap water quality is poor. (Sinha-OEIS)  
W78-12776

**ACTIVATED CARBON AND PREPARATION THEREOF**,  
Sunitomo Durez Co., Ltd., Tokyo (Japan). (Assignee).

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5F—Water Treatment and Quality Alteration

T. Aoki, Y. Kako, T. Kikuga, and K. Hatano.  
U.S. Patent No. 4,082,661, 6 p, 2 tab, 12 ref; Official Gazette of the United States Patent Office, Vol 969, No 1, p 269, April 4, 1978.

Descriptors: \*Patents, \*Water purification, \*Water treatment, \*Water quality control, Filtration, \*Activated carbon, Separation techniques, Absorption, Resins, Pyrogens, Ceramics.

For filtration and removal of alien substances from distilled water used as medium for medical injection fluid, alcoholic drinks, refreshing drinks and other liquids which do not permit the presence of so-called "pyrogen" i.e., fever-generating substances, there is an urgent need for developing more effective filtration materials. The present invention is based on the discovery that excellent activated carbon filtration materials are obtained by impregnating inorganic porous bodies such as conventional ceramic filter tubes or plates and the like, with thermosetting phenolic resins then drying the curing the resins and further baking and carbonizing such resin products in an inert atmosphere. It was also discovered that the sorptive ability of these products was remarkably enhanced by synergism between the physical filtration effect of the tube or plate and the chemical sorption effect of the activated carbon on the surfaces, thereby providing activated carbon having possibilities of various shapes with improved absorptive power for the elimination of pyrogen. (Sinha-OEIS)

W78-12786

**WATER CONDITIONING PROCESS,**  
Rohm and Haas Co., Philadelphia, PA. (Assignee). R. Kunin.

U.S. Patent No. 4,083,782, 4 p, 2 tab, 6 ref; Official Gazette of the United States Patent Office, Vol 969, No 2, p 636, April 11, 1978.

Descriptors: \*Patents, \*Water softening, \*Demineralization, \*Water treatment, Water quality control, Water purification, Ion exchange, Resins, Heavy metals, Regeneration.

Acid waters may be made alkaline, hard waters softened, and dissolved heavy metals substantially removed from any water supply by the simple treatment with one carboxylic ion exchange resin without requiring complicated tank systems or expensive instrumentation. The carboxylic resins which may be used are those in which the carboxylic acid group is provided by copolymerizing methacrylic and a suitable crosslinking monomer such as divinyl benzene. The resins are intended to be used in their alkali metal salt or ammonium salt form. A suitably sized resin bed may be established by any known method to suit the extent and nature of the operation involved. The water to be treated is passed through the resin bed. The resin when exhausted may be regenerated by either a two-step acid/alkali technique or by a one-step technique using a citric or fumaric acid solution or a poly or hexamethosphosphate solution. Water obtained by this method is substantially free of hardness ion, dissolved heavy metal ions and has a corrected pH between 7 and 9.5, preferably between 8 and 8.5. (Sinha-OEIS)

W78-12800

### 5G. Water Quality Control

**A GUIDE TO THE NEW YORK STATE ENVIRONMENTAL QUALITY REVIEW ACT,**  
Cornell Univ., Ithaca, NY.

For primary bibliographic entry see Field 6E.  
W78-12104

**MANAGEMENT OF SWINE MANURE FOR THE RECOVERY OF PROTEIN AND BIOGAS,**  
Oregon State Univ., Corvallis. Dept. of Soil Science.

For primary bibliographic entry see Field 5D.

W78-12108

**INTERACTION OF ROOT GROWTH AND REFUSE DECOMPOSITION IN A SANITARY LANDFILL,**  
Alabama Agricultural Experiment Station, Auburn.

V. D. Browning, and F. J. Molz.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 717, Price codes: A03 in paper copy, A01 in microfiche. Alabama Water Resources Research Institute, Auburn, Bulletin 32, Auburn University, July 1978, 20 p, 5 fig, 1 tab. OWRT A-044-ALA(1).

Descriptors: \*Root growth, \*Sanitary landfill, \*Leachates, Degradation(Decomposition), Vegetated lysimeters.

Two sets of lysimeter experiments involving shrubs or trees and forage crops were performed. The objective was to study the interaction of root growth and refuse decomposition in sanitary landfill materials. Slash pine grew very well; its roots penetrated all refuse layers within 10 months after planting. Thorny elaeagnus did not appear as healthy as pine during wet seasons. Forage crops grew well but tended to have shallow root systems as compared to the trees and shrubs. Roots grew into and through refuse if no soil was available but grew around it if soil channels were accessible. Homogeneous mixtures of soil and refuse did not promote extensive root growth relative to other treatments. A major effect of vegetation was to increase oxygen concentration in the soil-refuse mixtures. This promoted a greater than normal amount of aerobic decomposition. The soil-refuse mixtures in the vegetated lysimeters underwent several wetting and drying cycles each year, while the material in fallow lysimeters stayed at or near saturation. The net result of this altered water-oxygen balance was for the vegetated lysimeters to produce a decreased leachate volume but an increased leachate potency as measured by COD (Chemical Oxygen Demand), TKN (Total Kjeldahl Nitrogen), and TS (Total Solids). Dry weight measurements showed an increased rate of refuse decomposition in the vegetated lysimeters relative to the fallow controls.

W78-12110

**ESTIMATING RUNOFF POLLUTION FROM LARGE URBAN AREAS—THE DELAWARE ESTUARY,**

Rutgers - The State Univ., New Brunswick, NJ.  
For primary bibliographic entry see Field 5B.  
W78-12111

**A COMPARATIVE ECOLOGICAL STUDY OF THE CALIFORNIA CRAYFISH, PACIFASTACUS ZENIUSCULUS (DANA), FROM TWO SUBALPINE LAKES,**  
California Univ., Davis. Div. of Environmental Studies.

For primary bibliographic entry see Field 2H.  
W78-12112

**ECOLOGICAL STUDIES OF THE CALIFORNIA CRAYFISH, PACIFASTACUS LENIUSCULUS, WITH EMPHASIS ON THEIR GROWTH FROM RECYCLING WASTE PRODUCTS,**  
California Univ., Davis. Div. of Environmental Studies; and California Univ., Davis. Inst. of Ecology.

C. R. Goldman, J. C. Rundquist, and R. W. Flint.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 782, Price codes: A0 in paper copy, A01 in microfiche. Presented at Second International Crayfish Symposium, Baton Rouge, LA, 1974, p 481-487, 16 ref. (California Water Resources Center Project UCAL-WRC-W-475) OWRT A-056-CAL(3).

Descriptors: \*Crayfish, Water reuse, \*Temperature, Recycling.

This research has two main objectives. The first is an investigation of the ecological role of *Pacifastacus leniusculus* in its natural habitat such as Lake Tahoe, the Sacramento River, and the coast range streams and lakes. The second objective involves cooperative research around the world as regards intensive crayfish culture. This paper reviews previous work and present outlook for the two objectives. (Snyder-Calif, Davis)  
W78-12113

**THE CULTURE OF CRAYFISH FOR WASTE RECYCLING AND HUMAN CONSUMPTION,**  
California Univ., Davis. Dept. of Animal Science; and California Univ., Davis. Div. of Environmental Studies.

G. A. E. Gall, and C. R. Goldman.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 702, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, June 1978, 12 p, 9 ref. (California Water Resources Center Project UCAL-WRC-W-475). OWRT A-056-CAL(5).

Descriptors: \*Crayfish, Water reuse, \*Effluents, \*Nitrates, \*Phosphorus, \*Recycling.

An experimental watercress-crayfish culture system was developed which received a nutrient-rich effluent from a trout hatchery. The watercress system effectively stripped nutrients from effluent water and provided acceptable growth of watercress. The watercress removed 98% of the nitrate-nitrogen and 92% of the total phosphorus reducing the level of these two nutrients to near the level observed in the hatchery inflow supply. However, there was a significant increase of particulate organic matter in the effluent from the watercress growing-beds. Feeding trials indicated that watercress combined with a protein supplement provides a satisfactory diet for crayfish in terms of both growth rate and mortality. A detailed analysis of the growth of young crayfish from hatching through the fifth molt demonstrated that early growth involves two phases. During the larval, maternal-dependent stage, growth is linear and proceeds at a rapid rate. However, growth during the juvenile stage is exponential in nature and relatively slow during early stages. The optimal temperature for growth appeared to be in the ranges of 17-22 deg C. A successful system of stripping eggs from the female and hatching them in a drip-type egg incubator was developed which yielded a 90% hatch and normal metamorphosis. (Snyder-Calif, Davis)  
W78-12114

**WATERCRESS-CRAYFISH POLYCULTURE AS AN ECONOMIC MEANS OF STRIPPING NUTRIENTS FROM ENRICHED WATERS,**  
California Univ., Davis. Div. of Environmental Studies; and California Univ., Davis. Dept. of Animal Science.

J. Rundquist, G. Gall, and C. R. Goldman.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 700, Price codes: A02 in paper copy, A01 in microfiche. Presented at Proc. 3rd International Symposium Freshwater Crayfish, Kuopio, Finland, Dec 1976, 12 p, 2 fig, 4 tab, 25 ref. (California Water Resources Center Project UCAL-WRC-W-475). OWRT A-056-CAL(2).

Descriptors: \*Crayfish, \*Nitrates, Water reuse, \*Effluents, Nutrients, Fish diets.

An experimental watercress-crayfish polyculture system is described. The watercress bed receives nutrient-rich effluent from a connecting trout hatchery and effectively strips nitrates, ammonia, and phosphorus from the waters. The harvested watercress also provides a clean and easy food source for crayfish. Preliminary feeding trials indicate that the watercress combined with protein supplement provides a satisfactory crayfish diet in terms of both growth and mortality. The develop-

Water Quality Control—Group 5G

ment of watercress-crayfish polyculture is economically promising because of three valuable outputs -- cleaner water, watercress, and crayfish. (Snyder-Calif, Davis)  
W78-12115

**ENVIRONMENTAL IMPACT RESULTING FROM UNCONFINED ANIMAL PRODUCTION**, Louisiana Tech Univ., Ruston. Dept. of Agricultural Engineering.  
J. W. D. Robbins.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 373. Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA-600/2-78-046, Feb 1978. 34 p, 10 tab, 34 ref.

Descriptors: \*Environmental effects, \*Nonpoint pollution sources, Water pollution, \*Agricultural runoff, \*Farm wastes, Unconfined animal production, Cattle wastes, Sheep wastes, Swine wastes, Pasture, Range.

Knowledge related to environmental effects of unconfined animal production is outlined and evaluated. Animal species include cattle, sheep, and hogs. All available data indicate that pollutant yields from pasture and rangeland operations are not directly related to the number of animals or amount of wastes involved. Rather, these nonpoint source problems are intimately related to hydrogeological and management factors and are best described as the results of the erosion/scidiment phenomenon. Unconfined livestock production can cause changes in vegetative cover and soil physical properties that may result in increased rainfall runoff and pollutant transport to surface waters. The most common stream water quality result is elevated counts of indicator bacteria. Increased levels of inorganic and organic sediments with associated plant nutrients and oxygen demands may result from problem areas. These areas are usually only a small portion of the total production system and are readily identified by observation. Generally the pollutant levels from the remainder of the production site are not discernible from background levels. If other changes, such as those affecting groundwater quality, occur, they are of no environmental consequence. A major challenge remaining is to demonstrate cost-effective routes toward achievement of various levels of pollution control from unconfined animal production. (East Central)  
W78-12130

**EFFECT OF VEGETATION ON LANDFILL STABILIZATION**, Auburn Univ., AL. Dept. of Civil Engineering.  
F. J. Molz, and V. D. Browning.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 888. Price codes: A02 in paper copy, A01 in microfiche. Ground Water, Vol. 15, No. 6, p 409-415, Nov-Dec 1977. 8 fig, 2 tab, 19 ref. OWRT A-051-ALA(1) and B-048-ALA(2).

Descriptors: \*Landfills, \*Vegetation effects, \*Leachate, Decomposition(Degradation), Ground water pollution, Revegetation, Evapotranspiration, Lysimeters, Water pollution, Chemical oxygen demand, Waste disposal.

Six types of vegetation were established successfully on lysimeters containing sanitary landfill materials. The vegetation grew well with the roots penetrating several refuse layers within one year. Leachate analysis indicated that vegetation and evapotranspiration (ET) reduced leachate volume and increased the rate of refuse decomposition. This was accompanied by production of a more potent leachate and a substantial increase in cumulative chemical oxygen demand. Therefore, this study suggests more potential ground-water pollution in a shorter period of time when vegetation is planted on a landfill. The net effect of ET on the stabilization of any particular landfill will be the

result of a complex interaction involving climate, vegetation, soil type cover material, landfill geometry, and other variables. This makes extrapolation of these results to a particular field situation rather difficult.  
W78-12136

**EVAPOTRANSPIRATION FROM WATER HYACINTH IN TEXAS RESERVOIRS**, Texas A and M Univ., College Station. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2D.  
W78-12155

**WATER RESOURCES AND THE LAND-WATER INTERFACE**, Illinois Univ. Urbana-Champaign. Dept. of Ecology, Ethology, and Evolution.  
For primary bibliographic entry see Field 5B.  
W78-12164

**ADVANCEMENTS IN OIL SPILL TRAJECTORY MODELLING**, Dow Chemical Co., Freeport, TX. Process and Computer Engineering; and Texas A and M Univ., College Station.  
For primary bibliographic entry see Field 5B.  
W78-12173

**MARINE POLLUTION IN KUWAIT**, Millersville State Coll., PA.  
For primary bibliographic entry see Field 5B.  
W78-12174

**STRATIFIED WATER CIRCULATION FORECASTING FOR WATER QUALITY MANAGEMENT PLANNING IN THE COASTAL ZONE**, Raytheon Co., Portsmouth, RI. Environmental and Oceanographic Services Dept.  
For primary bibliographic entry see Field 5B.  
W78-12175

**OIL SPILL IDENTIFICATION SYSTEM**, Coast Guard Research and Development Center, Groton, CT.  
For primary bibliographic entry see Field 5A.  
W78-12181

**MODELING OF TIDE AND WIND INDUCED FLOW IN SOUTH BISCAYNE BAY AND CARD SOUND**, Miami Univ., FL.  
For primary bibliographic entry see Field 2L.  
W78-12187

**AN EXPERIMENTAL INVESTIGATION OF SOME COMBINED FLOW SEDIMENT TRANSPORT PHENOMENA**, North Carolina State Univ. at Raleigh. Center for Marine and Coastal Studies.  
For primary bibliographic entry see Field 2L.  
W78-12188

**FLOW-THROUGH MICROCOSMS FOR SIMULATION OF MARINE ECOSYSTEMS: DEVELOPMENT AND INTERCOMPARISON OF OPEN COAST AND BAY FACILITIES**, Naval Undersea Center, Kailua, HI. Div. of Chemistry and Environmental Sciences.  
R. S. Henderson, S. V. Smith, and E. C. Evans, III.  
Available from National Technical Information Service, Springfield, VA 22161 as AD-A035 331. Price codes: A05 in paper copy, A01 in microfiche. Naval Undersea Center Technical Paper No. NUC-TP-519, October 1976. 87 p, 25 fig, 11 tab, 31 ref.

Descriptors: \*Ecosystems, \*Water chemistry, \*Water quality, \*Simulation analysis, Hawaii, Bays, Nutrients, Biota, Outer Continental Shelf.

A low-nutrient flow-through seawater facility was constructed on a seaward side of Mokapu Peninsula, Oahu, Hawaii. This facility complements a system of similar design existing in the nearby high-nutrient environs of Kaneohe Bay. The double-plumbing innovation introduced at the newer facility has been very successful in reducing antifouling maintenance. Twelve outdoor tanks, each having a capacity of 160 gallons and identical dimensions, are present at each site. Flow rates are adjustable from 0.1 to 15.0 lpm. A calibration test was performed to determine interfacility differences in source water chemistry, organism recruitment, and growth of biota in the tanks. At both locales simple microcosms consisting of sorted coral rubble, sand, and varying numbers of herbivorous fish *Acanthurus triostegus*, were subjected to 6 months of flow-through at 10 lpm. The bay source water generated a diverse, near-climax community within 60 days. At the oceanic facility succession was much slower and community productivity was significantly lower than in the bay microcosms. The principal difference in source water macronutrients between the two facilities was the PO<sub>4</sub> content, the bay values being about double those of the oceanic source. NH<sub>3</sub> and NO<sub>3</sub> contents were nearly the same, but showed large fluctuations which correlated with tide and surf conditions. (Sinha-OEIS)  
W78-12189

**EVALUATING AQUACULTURAL USE OF THERMAL EFFLUENTS: AN APPLICATION OF SYSTEM DYNAMICS TO ENVIRONMENTAL PROBLEM SOLVING**, Rhode Island Univ., Narragansett. Coll. of Business Administration.  
D. W. Callaghan, S. S. Callaghan, and R. A. Comeford.  
Environmental Management, Vol. 1, No. 3, p 227-234, 1977. 3 tab, 3 fig, 11 ref.

Descriptors: \*Systems analysis, \*System dynamics, \*Aquaculture, \*Thermal water, \*Oysters, \*Model studies, \*Fisheries, Heated water, Thermal powerplants, Beneficial use, Computer programs, DYNAMO, Dynamic models, Flow rates, Water temperature, Nutrients, Economic feasibility.

System dynamics, a computer modelling approach to environmental problems, was used to evaluate application of coastal power plant thermal effluents in oyster aquaculture. Analysis showed that increased water temperature, coupled with other critical system variables such as supplemental nutrients and seawater flow, sufficiently stimulates oyster growth to yield a favorable economic return. The once-valuable U.S. oyster fishery has declined because of set failure, over-harvesting, poor shoreline management, pollution of coastal waters, excessive predation, and winter kills. Use of the heated power plant is possible only through secondary heating of seawater, since the effluent is contaminated by copper, toxic chemicals, and trace radioactivity. The proposed oyster finishing plant modelled in this study involves placement of oyster propagation units into pond containment structures, through which the seawater, indirectly heated by warm power plant effluent pumped through a heat exchanger, is fed. The containment is large enough to allow adequate circulation and supply of nutrients. A computerized model was developed to determine optimum values for system capacity, seawater flow rate, maximum above-ambient temperature increase and use or non-use of supplemental nutrients. The system dynamics technique involves developing a qualitative graphical representation of the feedback loops at work, expressing variable relationships in quantitative form, and combining resultant equations in a base routine. (Lynch-Wisconsin)  
W78-12196



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

**POLLUTION CONTROL IN A TWO-SECTOR DYNAMIC GENERAL EQUILIBRIUM MODEL,** Guelph Univ. (Ontario). Dept. of Economics. B. A. Forester. Journal of Environmental Economics and Management, Vol. 4, No. 4, p 305-312, December 1977. 2 fig, 9 r.f.

Descriptors: \*Economics, \*Pollution abatement, \*Model studies, \*General equilibrium models, Commodities, Equilibrium, Dynamic models, Pollution taxes (Charges), Standards, Consumers, Transportation, Air pollution.

The theoretical generation of pollution is incorporated into a simple dynamic general equilibrium model, and competitive and optimal control solutions are analyzed. The economy is assumed to produce two homogeneous commodities with different polluting characteristics. When both commodities cause pollution it is necessary to alter the production-consumption mix but not to curtail the output in each, as suggested by partial equilibrium analysis. This type of model sheds light on consumer choices related to such commodities as soap vs detergents, public vs private transportation, and returnable vs nonreturnable bottles. The analysis suggests that in the example of air pollution in a large urban area due primarily to automotive exhaust, an unregulated transportation system would lead consumers to overuse private transportation and underuse public transportation, because relative prices do not reflect the pollution-intensive nature of private automobiles. Private transportation is, as a result, artificially cheap. With severe urban pollution, the optimal strategy is to reduce use of private cars to less than the desired long-run target value and then to allow use to rise as air becomes cleaner. In a decentralized system a tax can be levied on private automobile mileage that is not imposed on public transportation. In all examples, the tax revenue collected must be returned as a lump-sum subsidy to households so that they can purchase the desired levels of the two commodities. (Lynch-Wisconsin) W78-12197

**POLLUTION CONTROL IN A SIMPLIFIED GENERAL-EQUILIBRIUM MODEL WITH PRODUCTION EXTERNALITIES,** Kansas Univ., Lawrence. Dept. of Economics. P. M. Comolli. Journal of Environmental Quality and Management, Vol. 4, No. 4, p 289-304, 1977. 4 fig, 1 tab, 11 ref.

Descriptors: \*Pollution abatement, \*Externalities, \*General equilibrium models, \*Model studies, \*Economics, \*Pollution taxes (Charges), Dynamic models, Static models, Regulation, Equilibrium, Standards, Public policy, Waste disposal, Water pollution control.

The effectiveness and conditions for success of a uniform tax for keeping pollution down to a specified minimum acceptable standard is assessed using a positive two-sector model with stationary capital and labor. In particular, conditions are determined for effective pollution control when the controlling agent operates with limited or no information about marginal private costs and social damage. Pollution externalities of the producer-producer type are considered. Use of an Uzawa-type general equilibrium model enables evaluation of both direct and indirect (price-induced) effects of the pollution tax. By assumption, output from the polluting sector can be diverted to pollution abatement. The tax-adjustment scheme posited is a 'stock-type' mechanism in which authorities raise the tax when pollution exceeds the target level, and vice-versa. Adjustment of this tax would always achieve the desired target, at least locally, if the decrease in pollution from the industrial sector (resulting from the marginal increase in overall pollution) was larger than the corresponding loss in the environment's assimilative capacity. In cases of normal solid-waste disposal

and continuously regenerated receiving bodies it is probable that the pollution tax would effectively control pollution. In other situations the stability condition is apt to fail and the target may not be realized; direct controls may then be required. (Lynch-Wisconsin) W78-12198

**A MODEL FOR SOLAR RADIATION CONVERSION TO ALGAE IN A SHALLOW POND,** Purdue Univ., Lafayette, IN. School of Mechanical Engineering. For primary bibliographic entry see Field 3E. W78-12270

**A MATHEMATICAL MODEL OF REGULARITIES IN POPULATION DYNAMICS OF PLANKTONIC BACTERIA AND DIATOMS IN SEVASTOPOL BAY (IN RUSSIAN),** Institute of Biology of the Southern Seas, Sevastopol (USSR). For primary bibliographic entry see Field 5B. W78-12282

**PERMISSIBLE CONTENT OF THE FLOCCULATION AGENT POLYOXYETHYLENE IN BODIES OF WATER (IN RUSSIAN),** Novosibirsk Sanitary Research Inst. E. M. Trofimovich, E. A. Strusevich, P. A. Kolesnikov, and V. I. Kazanin. Gig Sanit 7, p 23-25, 1976.

Descriptors: \*Lethal limit, \*Water quality standards, \*Polyoxyethylene, Biochemical oxygen demand, \*Toxicity, \*Flocculation agents, Potable water, Water treatment.

The effect of polyoxyethylene with MW 2,3 and 5 million on organoleptic properties, BOC 20 (biological oxygen consumption) and foaming of water was studied. Its acute toxicity was determined by intragastric and i.p. administration to mice and rats. The threshold dose of polyoxyethylene of a MW of 5 million was most toxic in case of its chronic entry into the body in drinking water. Maximum permissible concentration of polyoxyethylene with MW 2,3 and 5 million in water suggested that it be set at levels of 0.125, 0.1 and 0.02 mg/l, respectively.—Copyright 1978, Biological Abstracts, Inc. W78-12292

**MICROBIOLOGICAL STATE OF THE KIEV RESERVOIR IN THE SIXTH-SEVENTH YEARS OF ITS EXISTENCE (IN RUSSIAN),** Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii. For primary bibliographic entry see Field 5B. W78-12297

**MAIN ASPECTS OF THE ANTHROPOGENIC TRANSFORMATION OF LAKE ECOSYSTEM OF THE NORTHWESTERN EUROPEAN USSR (IN RUSSIAN),** Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya. For primary bibliographic entry see Field 2H. W78-12298

**MACROINVERTEBRATE AND WATER QUALITY-QUANTITY SURVEY OF OTTER CREEK, PIUTE COUNTY, UTAH,** Brigham Young Univ., Provo, UT. Center for Health and Environmental Studies. For primary bibliographic entry see Field 4D. W78-12303

**DECISIONS FOR DELAWARE: SEA GRANT LOOKS AT BEACH MANAGEMENT,** Delaware Univ., Newark. Coll. of Marine Studies. For primary bibliographic entry see Field 2L. W78-12312

**THE ROLE OF CYANIDE AS AN ECOLOGICAL STRESSING FACTOR TO FISH,** Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences. For primary bibliographic entry see Field 5C. W78-12385

**AN ASSESSMENT OF APPLICATION FACTORS IN AQUATIC TOXICOLOGY,** Environmental Research Lab., Duluth, MN. For primary bibliographic entry see Field 5C. W78-12386

**CLOSING REMARKS--AN OLD FROG CROAKS AN APPEAL FOR LOGIC,** Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife. P. Doudoroff. In: Recent Advances in Fish Toxicology, Environmental Protection Agency, Ecological Research Series, EPA 600/3-77-085, July 1977, p 191-202. 13 ref.

Descriptors: \*Water quality standards, \*Toxicity, \*Bioassays, On-site investigations, Reviews, Methodology, Dissolved oxygen, Nitrogen compounds, Administrative agencies, Administrative decision. \*Environmental Protection Agency, \*EPA, \*Red Book, Quality criteria for Water.

The U.S. Environmental Protection Agency Publication Quality Criteria for Water, EPA 440/9-76-023, is criticized for its policy, especially in regard to dissolved oxygen and cyanides, for ignoring the definitive scientific work available and utilizing discarded, rejected and erroneous data and observations in setting up the water quality standards. The standards are established by the EPA suggests that the authors of these standards are negligent, incompetent and dishonest and the ill-considered pronouncements of the EPA will retard advances in water pollution control for many years. (See also W78-12376) (EIS-Katz) W78-12387

**FRESHWATER MUSSELS UNIONIDAE, WHAT IS THEIR DISTRIBUTION IN SOUTH AFRICAN INLAND WATERS TODAY,** Albany Museum, Grahamstown (South Africa). For primary bibliographic entry see Field 6G. W78-12394

**OBSERVATIONS ON THE DIAGNOSIS AND TREATMENT OF SCHISTOSOMIASIS IN AN ENDEMIC AREA,** Rhodesia Univ., Salisbury. J. M. Goldsmid, and S. Rogers. South African Medical Journal (Cape Town), Vol. 51, No. 2, p 29-33. 1977. 20 ref, 2 fig, 3 tab.

Descriptors: \*Waterborne diseases, Human parasites, Public health, Histological examinations, Eggs, \*Epidemiology, Bilharzia, \*Schistosomiasis, Schistosoma Haematobium, Schistosoma mansoni, Cercariae, Rhodesia, Southern Africa.

Attempts are made to evaluate the criteria used in the diagnosis of schistosomiasis in an endemic bilharzial area. The discussion deals with the possible value of criteria such as egg recovery, rectal biopsy specimens, eosinophilia, hepatomegaly, and serological and skin tests. A rational approach to the treatment of patients with schistosomiasis is proposed and features such as probability of re-infection are taken into account. (So Afr Water Info Ctr) W78-12395

**SOUTH AFRICAN MARINE POLLUTION SURVEY REPORT 1974-1975,** Council for Scientific and Industrial Research, Johannesburg (South Africa). For primary bibliographic entry see Field 5B.

## Water Quality Control—Group 5G

W78-12400

**CLEAN ON STREAM,**

W. H. Rapson.

Saccap Action News, Vol. 3, No. 1, p 23-24, 1977. 1 illustr.

Descriptors: \*Paper industry, \*Water pollution, \*Pulp wastes, Process design, Economic justification, Pollution prevention technology, Plant modifications, Effluent quality standards, Closed system, Great Lakes paper company, Canada.

About one fifth of the world's water pollution can be laid to the door of the pulp and paper industry. Few experts will put their names to a precise figure but that seems to be a fair guess. As demand for paper expands with worldwide economic development, so, inexorably, does the attendant pollution. An economic, non-polluting technology for pulp and paper has been a long time coming but has finally arrived with the Great Lakes Paper Company's new Thunder Bay (Ontario, Canada) plant now entering production. This article by one of the two inventors of the key innovation gives a technical insight into the kind of modifications needed to transform conventional plant design to meet modern environmental standards. (So Afr Water Info Ctr) W78-12403

**SCHISTOSOMIASIS AND CARCINOMA OF THE BLADDER IN ZAMBIA,**

Zambia Univ., Lusaka.

S. B. Bhagwande.

South African Medical Journal (Cape Town) Vol. 50, No. 41, p 1616-1620, 1976. 28 ref, 3 tab, 4 fig.

Descriptors: \*Human parasites, \*Waterborne diseases, Public health, \*Carcinoma, Bladder, Schistosomiasis, Bilharzia, Schistosoma mansoni, Schistosoma haematobium, \*Zambia, Southern Africa.

Carcinoma of the bladder is the third most important malignancy seen in Zambia, accounting for nearly 9% of all malignancies seen in the Department of Pathology at the University of Zambia. A review of 217 cases of carcinoma of the bladder seen in the department over a 5 year period revealed a preponderance of well-differentiated squamous cell carcinoma (75%). Of the 217 cases, 65% had concomitant schistosomiasis. These tumours tended to occur in a younger age group than that reported from England and North America. The pattern of pathology conforms with that reported from other parts of Africa with hyperendemic and endemic schistosomiasis. The aetiological role of schistosomiasis in bladder cancer is critically examined. (So Afr Water Info Ctr) W78-12406

**PESTICIDES AND THE SOUTH AFRICAN POPULATION,**

Department of Agricultural Technical Services, Pretoria (South Africa).

I. H. Wiese.

South African Medical Journal (Cape Town), Vol. 50, No. 44, p 1801-1805, 1976. 15 ref, 3 tab.

Descriptors: \*Pesticides, \*Legislation, \*Public health, Hazardous wastes, Accumulation, Insecticides, Pesticide residues, Toxic wastes, Environmental impact, Chlorinated hydrocarbons, Organophosphorus pesticides, \*DDT, \*BHC, \*Dieldrin, \*South Africa.

Legislation which has a bearing on pesticides, and its current implementation by the State departments of Agricultural Technical Services and Health, are discussed. Organophosphate compounds account for about 80% of all deaths from pesticides and for about 60% of nonfatal cases of intoxication. In South Africa levels of lipophilic

compounds in human adipose tissue are generally well under the world average and are demonstrating a progressive downward trend. (So Afr Water Info Ctr) W78-12407

**SUMMARY OF FRESHWATER POLLUTION****LEGISLATION IN SOUTH AFRICA,**

Department of Planning and the Environment, Pretoria (South Africa).

A. Darracott.

Environment RSA (Pretoria), Vol. 2, No. 1, p 4-5, 1975.

Descriptors: Water supply sources, Watershed protection, Water reuse, \*Pollution survey, Water quality standards, Public health, Saitary criteria, Water quality control, \*Legislation, Sewage treatment, Sewage disposa, Drainage systems, Potable water, \*South Africa.

A summary of current (1975) pollution control legislation concerning water in the Republic of South Africa. Areas of responsibility, penalties, relevant laws and body of jurisdiction are tabulated. (So Afr Water Info Ctr) W78-12412

**THE TALE OF A LAKE,**

Transvaal Provincial Administration, Pretoria (South Africa). Div. of Nature Conservation.

For primary bibliographic entry see Field 2H.

W78-12413

**SIMPLIFICATION OF WASTE WATER PROBLEMS THE FABRIC LINED PURIFICATION PLANT.**

For primary bibliographic entry see Field 5D.

W78-12415

**MYRIOPHYLLUM, A POWERFUL THREAT TO OUR WATER SUPPLIES,**

Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.

A. Jacot Guillarmod.

Environment RSA, Vol. 4, No. 1, p 3-5, 1977.

Descriptors: \*Aquatic weeds, Fish ponds, Herbicides, Water plants, Dams, Reservoirs, Rivers, Canals, Marinas, Saline water, Estuaries, Water supply, Limnology, \*Aquatic weed control, Myriophyllum aquaticum, Myriophyllum spicatum, Parrot feather, \*Water milfoil, South Africa.

The threat is discussed that the aquatic weed Myriophyllum aquaticum (water milfoil, parrot's feather, waterduisendblaar) poses to South African rivers, dams and lakes. The plant, originally from South America, was introduced into South Africa more than fifty years ago as an attractive fish pond plant, and has spread throughout Southern Africa from the Cape of the borders of Zambia. The plant is rooted on the banks of a water body and forms a dense and deceptively stable mat of tangled shoots above water level. As the plant grows it lessens the water flow and silt is deposited, building up a shelf on which the plant can extend itself further out. Each small portion of the plant, containing a node, is capable of growing, and in this way is spread by small portions clinging to motorboat propeller shafts etc. All species of Myriophyllum have been declared noxious weeds, which is most unfortunate as Myriophyllum spicatum, the indigenous species, is a beneficial plant which will probably suffer more in eradication attempts than Myriophyllum aquaticum which cannot effectively be eradicated by chemical or mechanical means. A comprehensive advertising campaign is suggested, so that the public may become aware of how dangerous a water weed this plant is. (So Afr Water Info Ctr) W78-12427

**NOT ONE DROP OF EFFLUENT - HYDROCHLORIC ACID RECOVERY FROM SPENT PICKLE LIQUOR.**

Chemsa, Vol. 3, No. 2, p 20-22, 1977.

Descriptors: \*Chemicals recovery, \*Hydrochloric acid, Pickle liquor, Spent liquors, \*Industrial wastes, Regeneration, Zinc chloride, Metals separation, Roasting, Pollution abatement, Water pollution, \*South Africa.

The rules and regulations regarding water pollution in the Vaal river catchment area are just about the strictest in the world, which is understandable, as the Vaal river is the major source of water for developments situated in its own catchment area. Faced with trouble from the Water Affairs Department, prominent galvanisers from the reef approached Woodhall Duckham for advice on a pollution - conscious method of disposing of their spent pickling acid effluent. As the cost of installing recovery plants at individual industries were prohibitive a consortium of companies, each buying shares in one central plant, was decided upon for financial reasons. The Heriotdale plant was erected, which regenerates Hydrochloric acid, which is sold back to the individual galvanisers. There is not a drop of effluent emanating from the Heriotdale plant and as much as 70% of the total acid requirements are regenerated whilst the ferrous oxide which is reclaimed is sold as pigment to the paint, cement and roof-tile industry. (So Afr Water Info Ctr) W78-12432

**IS THE WATER HYACINTH A CURSE OR BLESSING.,**

F. Schafer.

Farmer's Weekly, March 2, p 19-24, 1977.

Descriptors: \*Water hyacinth, \*Aquatic weed control, Nutrient removal, Sewage treatment, Plant growth, Growth rate, Eutrophication, Heavy metals, Animal feeds, Gas production, Water pollution, Eichhornia, \*South Africa.

Notwithstanding the fact that Government and private enterprise have spent millions on trying to control or destroy the prolific water hyacinth, which plagues some of the country's most popular recreational dams and rivers, the hyacinth still abounds and at present there seems to be no stopping its relentless advance. The author however, points out that researchers in the USA have established that man fails to recognise fully the water hyacinth's potential value in pollution control, and as a source of energy, food and livestock feed and fertilizer. Although South African scientists concede the possible uses they feel that these would not be economically viable in this country and state that even if utilisation of water hyacinths were an economic proposition, mankind would still have to overcome what was probably the biggest stumbling block of all at present; an efficient method of harvesting the plants. (So Afr Water Info Ctr) W78-12433

**THE NECESSITY OF ENVIRONMENTAL PROTECTION,**

Johannesburg City Council (South Africa).

For primary bibliographic entry see Field 6G.

W78-12435

**ENVIRONMENTAL POLLUTION CONTROL ON MINES,**

J. T. Van Zyl.

Volksgesondheid, Johannesburg, Vol. 76, No. 3, p 63-76, 1976.

Descriptors: \*Environmental pollution, \*Pollution abatement, \*Mines, Air pollution, Dust, Water pollution, Water laws, \*Mine drainage, \*South Africa.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

One of the problems facing the mining industry is environmental pollution. For every ton of ore mined there is extra waste to be disposed of. The author considers the problems of air, noise, water and visual pollution and describes how the Witwatersrand mining industry takes pride in the efforts it has made to provide the citizens of the areas in which it operates with acceptable environmental conditions. (So Afr Water Info Ctr) W78-12439

**OIL IN THE MARINE ENVIRONMENT.** Department of Planning and the Environment, Cape Town (South Africa). A. Darracont. Environment Republic of South Africa, Pretoria, Vol 4, No 3, p 2-4, 1977. 30 refs.

Descriptors: Marine pollution, \*Oil spills, \*Toxicity, Food chains, Shellfish, Marine animals, Marine environment, Ecology, Accumulation, Aromatic hydrocarbons, Lobsters, Cape coast, Natal coast, False Bay, \*South Africa.

Discussion is presented of the effects and accumulation of oil in the marine environment with special reference to South Africa, and among other things touches on the effects of marine life, the accumulation of hydrocarbons, some of which are carcinogenic, in marine life, the effect on man and accumulation on man and the effects and accumulation of oil pollution in South Africa. W78-12447

**JOHANNESBURG ON JUKSKEI.** Saccap Action News, Vol 2, No 2, p 18, 19, 36, 1977.

Descriptors: \*River pollution, \*Industrial wastewater, Municipal wastewater, Oil pollution, Litter, River banks, Legislation, Conservation, Solid wastes, Landfill, Leaching, Recreation, Environmental pollution, Water quality, Westdene dam, \*Johannesburg, \*Jukskei river, Hartbeespoort dam, \*South Africa.

Efforts are described of Mrs Wendy Bodman, a Sandringham housewife, who has been appointed Transvaal liaison officer for the South African Council of conservation and Anti-Pollution, to mobilise forces to clear the Jukskei River of pollution. She smiled her way through the corridors of power in seven municipalities and today has staunch friends in every municipality bordering Johannesburg. Thanks to her efforts, large portions of the Jukskei and its tributaries flow free and clear today. (So Afr Water Info Ctr) W78-12454

**WATER FOR THE FRIENDLY CITY.** For primary bibliographic entry see Field 5F. W78-12456

**DOLPHINS DELIGHT AT THE OCEANARIUM.** S. C. Rutherford. Prospect, Vol 15, No 2, p 11, 1976.

Descriptors: \*Dolphins, Chlorine, \*Filtration, Seawater, Health hazards, Marine animals, Aquaria, Flocculation, Suspended solids, pH effect, Marine bacteria, Oceanarium, Aluminium sulphate, Port Elizabeth, \*South Africa.

The water treatment and filtration system used at the Port Elizabeth oceanarium are described. Water in a confined area produces types of bacteria not normally encountered by dolphins living under natural conditions. Thus for dolphins in captivity the control of bacteria is essential. Aluminium sulphate and chlorine is used to produce maximum clarity, algae control and a near bacteria-free environment. (So Afr Water Info Ctr) W78-12457

**ENVIRONMENTAL CONTROL IN THE MINING INDUSTRY.** G. H. Grange.

Journal of the South African Institute of Mining and Metallurgy, Johannesburg, Vol 78, No 2, p 19-23, 1977. 3 refs.

Descriptors: \*Mines, Legislation, Pollution abatement, Air pollution, \*Water quality control, Environmental pollution, \*Mine wastes, Dumping, Soil conservation, \*South Africa.

Details are given of three legal controls for the pollution of the air, the water, and the land, together with brief histories of the developments leading up to these controls. Attention is drawn to the fact that legal action may be instituted against a mine under common or other laws where pollution causes provable damage or loss. It is suggested that an international conference should be held to define the philosophies and principles on which to base not only the necessary legislation for environmental control but also the machinery by which the controls can be administered. (So Afr Water Info Ctr) W78-12459

**SOME ASPECTS OF ENERGY AND THE ENVIRONMENT IN THE STEEL INDUSTRY.** J. J. Heynike.

Journal of the South African Institute of Mining and Metallurgy, Johannesburg, Vol 78, No 2, p 24-33, 1977. 5 ref, 14 fig, 8 tab.

Descriptors: \*Iron and Steel industry, \*Pollution abatement, \*Energy consumption, \*Air pollution, Environmental pollution, Process improvements, Energy conservation, Metal processing wastes, Coke plant wastes, Furnaces, Pollutants removal, \*South Africa.

The relationship between population growth and steel consumption since the beginning of the twentieth century is indicated, reference being made to the increasing capacity of production units and the resultant increased pollution in the same area. The need for the control of fugitive emissions with its associated high cost is pointed out. There is a direct relationship between energy usage and reduced pollution. Several practical examples of air-pollution control systems are described as applicable to the main metallurgical steel processes of today. In conclusion, reference is made to the fact that, with the improvements attained in reducing pollution, the public will not tolerate a decline in the standards already attained. Environmental control and better energy utilization will continue to be important aspects of steel-plant design and operation. (So Afr Water Info Ctr) W78-12460

**HYDROCHEMICAL CHARACTERISTICS OF THE GORYN RIVER AND SOME OF ITS TRIBUTARIES (IN RUSSIAN).** Akademiya Nauk URSS, Kiev. Inst. Hidrobiologii. For primary bibliographic entry see Field 5B. W78-12462

**DIMETHOATE APPLIED BY MICROJET AND DRIP IRRIGATION FOR CONTROL OF CITRUS PSYLLA, TRIOZA ERYTREA E TRIOZA ERYTREA, THE VECTOR OF GREENING DISEASE.** For primary bibliographic entry see Field 3F. W78-12473

**FRENCH ACHIEVEMENTS IN THE FIGHT AGAINST WATER POLLUTION IN THE PULP AND PAPER INDUSTRY.** Energy, Braamfontein, Vol 3, No 6, p 21-25, 1977. 4 tab, 2 fig.

Descriptors: \*Paper industry, \*Water quality control, \*Pollution abatement, \*Pulp wastes, Effluents quality standard, Kraft mill wastes, Optimization, Process improvements, Industrial wastewater treatment, Bleaching, Waste recovery, Decolourization, Ultrafiltration, Biological treatment, Activated sludge, Aerolox, Lagooning.

The pollution generated by the paper industry represents, in the case of France, 20% of total industrial water pollution. However the low toxic content of these effluents, whose polluting effect is measured principally by their BOD, COD, and colour contents, should be stressed. This pollution is not equally divided between the two branches of paper manufacture; it is estimated that the preparation of pulps alone is responsible for 90% of total papermaking pollution, the manufacture of paper only being accountable for the other 10%. The article therefore, concentrates on the problems of pollution relating to pulp manufacture, and goes on to discuss methods of combating pollution, improvements of present installations, changing the cooking process, development of new techniques and treatment of effluents. (So Afr Water Info Ctr) W78-12484

**HYACINTH LAGOONS- LOW-COST SEWAGE TREATMENT.** For primary bibliographic entry see Field 5D. W78-12495

**GOING UNDERGROUND SAVES ON COSTS.** For primary bibliographic entry see Field 8D. W78-12497

**AERIAL SURVEILLANCE TO MONITOR WATER QUALITY IN CATFISH PONDS.** Mississippi State Univ., Mississippi State. Dept. of Wildlife and Fisheries. For primary bibliographic entry see Field 5A. W78-12526

**CHOICE BETWEEN RIVER QUALITY MODELS OF DIFFERENT DEGREES OF COMPLEXITY.** Nuclear Research Center, Karlsruhe (West Germany). Div. of Applied Systems Analysis. For primary bibliographic entry see Field 5B. W78-12533

**ON THE OPTIMIZATION TASK FOR WATER QUALITY MANAGEMENT.** Institute of Meteorology and Water Management, Wrocław (Poland). B. Deniszyk, and R. Krasnodebski. In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No. 125, p 245-251, 1978. 1 fig, 2 tab, 12 ref.

Descriptors: \*Water quality control, \*Management, \*Optimization, \*River systems, \*Networks, \*Cost minimization, Constraints, Treatment facilities, Size, Economic efficiency, Mathematical models, Systems analysis, Regions, Water pollution.

Assumptions, definitions, and notions needed for the development of an optimized river system model are formulated, and the general case of a river network is considered. The model presented herein can be applied for water quality operational control, for water management, and for investment projects aimed at water quality protection. The model can be developed, at least theoretically, for any number of installations (treatment plants, reservoirs, etc.), the costs of which are to be minimized. Examples of questions which can be



answered through the model are: (1) what sizes and types of treatments should be planned to maintain desired water quality and minimize total costs; and (2) what water discharge rates from existing reservoirs should be applied, in order to fulfill the same two objectives. Dealt with are models containing only one quality parameter. It is shown how the constraint region for controllable variables (e.g., purification rates of sewage) is built. A theorem is formulated showing in what cases the optimization task can be significantly simplified. The model development is illustrated by an example. (Bell-Cornell)  
W78-12534

#### SYSTEM DEVELOPMENT OF WATER RESOURCES AND WATER QUALITY CONTROL.

National Water Authority, Budapest (Hungary).

L. David.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No. 125, p 262-268, 1978. 2 fig, 5 ref, 1 append.

Descriptors: \*Water resources development, \*Water quality control, \*River basin development, Long-term planning, Hydrology, Optimum development plans, Mathematical models, Equations, Systems analysis, Water demand, Estimating, Water activities, Socio-economic conditions, Environmental requirements.

The purpose of this paper is to analyze the interconnection between water resources development and water quality control during river basin development (RBD) and to prepare a unified system model of the development of these basic activities. The basis of this analysis is the concept of unified development and the systems approach to the long-term river basin development process. The actual tasks of water quality control and water resources development in a river basin depend on the current stage and on the socio-economic, environmental and technical conditions of the development process in the basin. It is concluded that on a lower level of RBD, the increase of usable water resources and the water quality control (water purification, sewage treatment, etc.) could be developed independently. However, on a higher level of development, when the storage reservoirs, the water transfers, water users, and effluent dischargers have become numerous and their effects on each other and the region have a greater impact, the increase of usable water resources and the activities of water quality control could only be developed and managed in a unified system. Moreover, in a basin-wide, unified approach, activities can replace each other and can provide alternative development policies. (Bell-Cornell)  
W78-12536

#### A SIMPLE MATHEMATICAL MODEL OF QUANTITATIVE AND QUALITATIVE PROCESSES OCCURRING IN THE STREAM CHANNEL FOR WATER DISTRIBUTION CONTROL.

Institute of Meteorology and Water Management, Krakow, Poland. Krakow Div.

A. Adamczyk, R. Konieczny, H. Słota, and J. Grela.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No. 125, p 279-287, 1978. 4 fig, 1 tab, 8 ref.

Descriptors: \*Simulation analysis, \*Computer models, \*Water quality control, \*Water demand, \*Streams, \*Water distribution (Applied), \*Vistula River (Poland), Channels, Reservoirs, Measurement, Gaging stations, Pollutants, Optimization,

Biochemical oxygen demand, Dissolved oxygen, Operation research, Equations, Regression curve.

In order to fully utilize the potential water resources of the Upper Vistula River basin, it was necessary to derive optimal control principles for the existing multireservoir system. Simultaneously, a problem emerged regarding the influence of the planned water distribution rules on the quantity and quality characteristics of this river downstream of the mouth of the Sola River; it became essential to establish operating rules which would guarantee an optimal mix between water demands and water quality control. This article discusses a simulation model of qualitative and quantitative processes occurring in the Vistula River between Pustynia and Niepolomice stations. The model allows for studying changes in the quality and quantity characteristics of the river at given points in space and time for different time intervals. The adapted principles regarding the structure of river systems, model parameters, output and input values, description methods as well as methods of flow transformation processes and pollutant concentration modeling are presented. (Bell-Cornell)  
W78-12538

#### WATER RESOURCES MANAGEMENT USING INTEGER PROGRAMMING MODELS.

Utah State Univ., Logan. Coll. of Engineering.

W. J. Grenney, and B. Finney.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No. 125, p 299-311, 1978. 3 fig, 5 tab, 7 ref.

Descriptors: \*Water resources, \*Management, \*Water quality, \*River basins, \*Linear programming, \*Simulation analysis, \*Integer programming, \*Cost minimization, Optimization, Waste water treatment, Standards, Streams, Pollutants, Constraints, Computer models, Equations, Algorithms, Mathematical models, Systems analysis, Prediction, Jordan River (Utah), Sensitivity analysis.

Two key areas of concern in water quality management for a river basin are: (1) deriving the least-cost combination for treatment of point and diffuse pollution sources that will satisfy water quality standards for various beneficial water uses; and (2) predicting the stream quality at various control points given the treatment combinations and pollutant discharges from activities within a river basin. The first problem is solved using a mixed integer linear programming algorithm subject to stream quality constraints that depend on the flow conditions and stream characteristics. The second problem is approached through the use of a simulation model to predict stream qualities, given the treatments and residual loadings as solved by the optimization model. This article describes the linking of the two models in order to capitalize on the unique advantage of each in managing river basin water quality. Considered is the application of the modeling approach to two problems: a sensitivity analysis and the Jordan River in Utah. (Bell-Cornell)  
W78-12540

#### WATER QUALITY MODELLING AS A TOOL FOR DECISION MAKING IN HUNGARY.

Research Inst. for Water Resources Development, Budapest (Hungary).

B. Hock.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No. 125, p 312-321, 1978. 1 fig, 9 tab, 5 ref.

Descriptors: \*Water quality, \*Decision making, \*Management, \*Long-term planning, \*Mathematical models, \*Cost minimization, Annual, Sewage, Waste water treatment, Hydrologic aspects, Standards, Constraints, Equations, Systems analysis, Linear programming series, Optimization, River Sajo (Hungary).

The objective is to develop a water quality management programme as a tool for decision making in the Sajo catchment area, Hungary. The basic concept of the water quality management model is to optimize the net annual sewage and waste water treatment costs, considering the river's water quality conditions—the decomposition process. Based on some above principle, a complex model is developed that accounts for the hydrological conditions of the Sajo, sets river water quality standards, relates a system of alternative sewage and waste water treatment technologies to the most important point pollution sources, and selects an optimum solution by minimizing the net annual costs. The optimum solution is selected through the solution of linear programming series. The model is of long-term character, i.e., the sewage and waste water discharge data predicted for 1985 will be considered, and also the deadline for the completion of the construction works (management strategies) is set within the above period. The implementation of this programme will result in achieving water quality control — along the total Hungarian length of the River Sajo, the latter being one of the most polluted water courses in the country — at least as good as that defined by COMECON water quality standards class II, even in the case of low flow conditions; also it will provide a contribution to the improvement of the water quality of the Tisza River reach downstream from the mouth of the Sajo. (Bell-Cornell)  
W78-12541

#### OPTIMIZATION OF LONG-TERM SEQUENTIAL PROGRAMMES OF WATER QUALITY CONTROL.

Technical Univ. of Budapest (Hungary). Inst. for Water Management and Hydraulic Construction.

I. Ijjas, and J. Kindler.

In: Modelling the Water Quality of the Hydrological Cycle. Proceedings of the Baden Symposium, September 1978, Convened jointly by IIASA (Laxenburg, Austria) and IAHS (United Kingdom). IAHS-AISH Publication No. 125, p 335-342, 1978. 15 ref.

Descriptors: \*Water quality control, \*River systems, \*Construction, \*Long-term planning, \*Integer programming, \*Cost minimization, Optimization, Waste treatment, Treatment facilities, Reservoir storage, Inter-basin transfer, Low flow augmentation, Design flow, Constraints, Investment, Decision making, Equations, Mathematical models, Systems analysis, \*Waste load.

Achieving water quality levels compatible with the needs of man is of crucial importance. The correct design of a water quality management system requires that not only the scale of water quality control investments be considered, but also the order of their construction. Considered herein is a complex river system where water quality can be controlled by construction of waste treatment plants, storage reservoirs, and interbasin transfer facilities for low flow augmentation. It is assumed that alternative scenarios of future waste loads are given by the authorities concerned with regional and economic planning in the area. The future waste load levels and design flows are indicated for discrete time periods (e.g., every five years) over the entire time horizon subject to analysis. Depending on the water quality objectives related to each of these time periods, the waste discharges should be controlled so as to minimize the overall cost of the sequentially-implemented control measures. The problem is solved by application of zero-one integer programming. The self-purification processes occurring in the river system are

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

taken into account by the so-called 'pollution transition matrix'. (Bell-Cornell)  
W78-12543

#### MODEL STATE INFORMATION SYSTEM FOR THE SAFE DRINKING WATER PROGRAM. VOLUME I: SUBSYSTEM DESCRIPTION. DEFINITION OF SYSTEM REQUIREMENTS.

American Management Systems, Inc., Arlington, VA.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 860. Price codes: A08 in paper copy, A01 in microfiche. Prepared for Environmental Protection Agency, Washington, D.C., 15 June 1976. 153 p, 34 fig, 2 append.

Descriptors: \*Computer models, \*Water quality, \*Legislation, \*Information systems, \*Safe drinking water, Data management, Regulation, Computer programs, Timing, Water pollution, Standards, Inventory, Public systems, Compliance, Enforcement, Systems analysis.

The Model State Information System (MSIS) is a computer-based information system for use by individual States and/or EPA Regions to perform the minimum data management functions mandated by the Safe Drinking Water Act of 1974 (PL 93-523). Three major documents were produced by American Management Systems, Inc., for EPA, outlining the basic concepts of an informational data management system to meet the water quality monitoring and reporting requirements of the Act; these are dated June 15, 1976. This report presents the definition of the inputs, outputs, files, processing steps, and timing requirements of the third of these documents: Model State Information System for Safe Drinking Water Program. Part of a feasibility study, this report defines the elements of the proposed MSIS at the level of detail required to prepare reasonable estimates of resource requirements and costs of development and operation, either as a stand-alone system to be run on each state's facility, or as a centralized system to be run at EPA using STORET. Considered herein are the eight subsystems of MSIS: (1) public water supply inventory; (2) water quality compliance; (3) regulations; (4) Federal reporting; (5) variances and exemptions; (6) enforcement actions; (7) sanitary survey; and (8) operator and mailing. The first four subsystems comprise the basic package, required if any portion of the MSIS is to be used. States may select the base package and one or more optional sub-systems, depending on their volume of data and individual needs. (See also W78-12549 and W78-12550) (Bell-Cornell)  
W78-12548

#### MODEL STATE INFORMATION SYSTEM FOR THE SAFE DRINKING WATER PROGRAM. VOLUME II: EXHIBITS. DEFINITION OF SYSTEMS REQUIREMENTS.

American Management Systems, Inc., Arlington, VA.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 861. Price codes: A06 in paper copy, A01 in microfiche. Prepared for Environmental Protection Agency, Washington, D.C., 15 June 1976. Available from National Technical Information Service, Springfield, VA., PB No 258 861. 96 p.

Descriptors: \*Computer programs, \*Water quality, \*Information systems, \*Safe drinking water, \*Data management, Computer models, Systems analysis, Monitoring, Legislation.

The Model State Information System (MSIS) is a computer-based information system for use by individual states and/or EPA regions to perform the minimum data management functions mandated by the Safe Drinking Water Act of 1974 (PL 93-523). This report is concerned with the third of three major documents produced by American Management Systems, Inc., for EPA, outlining the

basic concepts of an information data management system to meet the water quality monitoring and reporting requirements of the Act. Exhibited are input forms, records description, reports layout and explanation, and code tables for 'Model State Information System for the Safe Drinking Water Program,' dated 15 June 1976. (See also W78-12548 and W78-12550) (Bell-Cornell)  
W78-12549

#### MODEL STATE INFORMATION SYSTEM FOR THE SAFE DRINKING WATER PROGRAM. VOLUME III: DATA ELEMENT DICTIONARY. DEFINITION OF SYSTEM REQUIREMENTS.

American Management Systems, Inc., Arlington, VA.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 862. Price codes: A10 in paper copy, A01 in microfiche. Prepared for Environmental Protection Agency, Wash D.C., 15 June 1976. 206 p.

Descriptors: \*Computer programs, \*Water quality, \*Monitoring, \*Information systems, \*Reporting, Computer models, Legislation, \*Safe drinking water, \*Programs, Regulation, Data management, Water supply, Enforcement, Compliance, Timing, Water pollution, Standards, Inventory, Public systems, Systems analysis.

The Model State Information System (MSIS) is a computer-based information system for use by individual States and/or EPA Regions to perform the minimum data management functions mandated by the Safe Drinking Water Act of 1974 (PL 93-523). This report presents the data element dictionary of system requirements for the third of three documents produced by American Management Systems, Inc., for EPA, outlining the basic concepts of an informational data management system to meet the water quality monitoring and reporting requirements of the Act; the third document is called, 'Model State Information System for the Safe Drinking Water Program,' dated June 15, 1976. The MSIS consists of eight subsystems, including public water supply inventory, regulations, variances and exemptions, and sanitary survey. Document 1 is a feasibility study of the development and implementation of an MSIS for EPA's Safe Drinking Water Program, and document 2 is an introduction to the MSIS; both are also dated 15 June 1976. (See also W78-12548 and W78-12549) (Bell-Cornell)  
W78-12550

#### OUTER CONTINENTAL SHELF OIL AND GAS INFORMATION PROGRAM.

Geological Survey, Washington, DC.  
For primary bibliographic entry see Field 7C.  
W78-12555

#### OUTER CONTINENTAL SHELF LEASING.

Bureau of Land Management, Washington, DC.  
Federal Register, Vol. 43, No. 19, p 3892-95, January 27, 1978.

Descriptors: \*Land management, \*Continental shelf, \*Environmental effects, Leases, Oil industry, State governments, Federal government, Legislation, Coasts, Aquatic environment.

This final rulemaking governs the timing and type of environmental studies to be undertaken by the federal Bureau of Land Management as needed for the assessment and management of environmental impacts on marine and coastal environments of the outer continental shelf as a result of oil and gas leasing. Another final rulemaking action by the Bureau sets up the procedure for releasing specified information regarding any proposed activity relating to the outer continental shelf to state and local governments to determine the impact of such development and plan accordingly. An affected state is defined in the regulations as any state: (1) the laws of which are the

laws of the United States for the affected portion of the shelf; (2) which is connected to any structure referred to in section (4)(a)(1) of the Outer Continental Shelf Lands Act; (3) which will receive oil extracted from the shelf; (4) which is designated by the federal Secretary of State as an area of significant impact; or (5) in which the Secretary designates that there is significant risk of serious damage to the marine environment. (Quarles-Florida)  
W78-12558

#### INDEPENDENT RENDERING INDUSTRY EFFLUENT LIMITATION AND GUIDELINES.

Environmental Protection Agency, Washington, DC.  
Federal Register, Vol. 42, No. 194, p 54417-20, October 6, 1977. 4 tab.

Descriptors: Effluents, \*Standards, \*Cost-benefit analysis, \*Federal water pollution control act, Oil, Regulation, Economic impact, Coliforms, Water quality standards, Water pollution treatment, Industrial wastes.

These final regulations issued by the federal Environmental Protection Agency established effluent limitations and new source performance standards for processing plants in the independent rendering industry which engages in the recovery of salable products from discarded animal materials. Certain pollutant limitations for existing plants are made less stringent while requirements for new plants are made more stringent than those originally promulgated. The allowance for cattle hide curing contained in the original new source regulation is restored. A discussion of public comment on the proposal is included, and it is concluded that a direct measure and limitation for oil and grease is essential. Oil and grease is a major constituent of rendering wastes. Monitoring costs are very minimal. All available information indicates the proposed BOD<sub>5</sub>, TSS, pH and fecal coliform limitations are appropriate. Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best achievable are set forth in detail, as are the standards of performance for new sources. The regulations include an economic impact analysis and also provide for certain small business administration loans. (Quarles-Florida)  
W78-12559

#### EXISTING SOURCES AND NEW SOURCE PERFORMANCE STANDARDS AND EFFLUENT LIMITATIONS AND GUIDELINES.

Environmental Protection Agency, Washington, DC.  
Federal Register, Vol. 42, No. 194, p 54417-20, October 6, 1977.

Descriptors: \*Federal Water Pollution Control Act, \*Industrial wastes, \*Regulation, \*Water pollution sources, Administrative agencies, Chemical wastes, Effluents, Federal government, Industries, Industrial wastes, Judicial decisions, Legal aspects, Standards, Waste water, Waste water treatment, Water pollution, Water quality, Water law, Legislation.

The Environmental Protection Agency (EPA) has promulgated effluent limitations and new source performance standards for processing plants in the independent rendering industry, under the authority of the Federal Water Pollution Control Act Amendments of 1972. The independent renderer recovers salable products such as fats, oils and proteinaceous meal from discarded animal materials. The effluent limited are: (1) BOD<sub>5</sub>, (2) TSS, (3) Oil and grease, (4) pH and, (5) fecal coliform. The effluent limitations establish the quantity or quality of pollutants that may be discharged from a point source after the application of the best available technology economically achievable. If a renderer conducts hide curing, he may adjust the standards for BOD<sub>5</sub> and TSS. Effluent standards

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

of performance for new sources are also included. No plant closures due to these regulations are projected. Required price increases and effects on employment, growth, and international trade are expected to be minimal. The regulations will make certain pollution limitations for existing plants (section 1983 requirements) less stringent and will make requirements for new plants more stringent than those originally promulgated. (Jordan-Florida)  
W78-12562

**ENVIRONMENTAL IMPACT REPORTS UNDER THE CALIFORNIA ENVIRONMENTAL QUALITY ACT: THE NEW LEGAL FRAMEWORK**, San Diego Univ., CA. School of Law. R. G. Hildreth.  
Santa Clara Law Review, Vol. 17, No. 4, p 805-26, Fall, 1977.

Descriptors: \*Environmental effects, \*Project planning, \*Research and development, \*Administrative agencies, Projects, Judicial decisions, Legislation, Local governments, Environmental control, Project benefits, Project feasibility, Project purposes, Economic justification, Damages, Federal government, Social aspects.

The California Environmental Quality Act (CEQA) is patterned after the National Environmental Policy Act. Its purpose is to minimize the adverse environmental effects of public and private projects. To accomplish this goal, the Environmental Impact Report is used. The report measures probable effects of proposed projects and is used by governmental authorities in determining whether to approve or disapprove of these projects. CEQA provides detailed procedures, yet it gives little guidance for those using the reports on how to comply with its requirements. Certain information should be included in each report. State guidelines, local government ordinances and judicial decisions are among these. A description of the project, its environmental impact, mitigation measures, and project alternatives should also be included. To conclude the report, all agencies consulted in its preparation should be listed. The decision-making agency which has approval power over the project must review the report and determine the feasibility of less harmful alternate projects. The courts can enforce compliance with the requirements of CEQA, yet have left unresolved how much weight will be given to a project's environmental costs and social and economic benefits. (Spiegel-Florida)  
W78-12563

#### RETHINKING. THE TIMETABLE FOR REFRESHING OUR WATERS,

E. A. Gee.  
The Conference Board RECORD, Vol. 13, No. 4, p 54-57, April, 1976.

Descriptors: \*Federal Water Pollution Act, \*Cost-benefit analysis, \*Water quality standards, \*Economics, Water pollution sources, Marginal benefits, Legislation, Water pollution treatment, Industries, Economic justification, Costs, Budgeting, Cost allocation, Planning, Economic feasibility.

The results of the first three years of work by the Congressionally established Commission charged with studying all aspects of the 1972 Federal Water Pollution Control Act (FWPCA) are examined in this article. A major result of the Commission's work has been the improved understanding of the source of water pollution. The Commission found that when the present law was passed; industry, municipal sewage, and non point sources each contributed approximately one-third of the total pollution load. Since the enactment of the FWPCA, dramatic progress has been made in the control of industrial discharges and city sewage. Once the 1977 technology is in place, nonpoint sources will be the major cause of water pollution.

Thus, increasing expenditures by industries and municipalities to meet the 1983 requirements will not solve the problems created by nonpoint sources. The author suggests that a more selective basis be used in treating remaining water quality problems. Higher standards should not be applied in instances where objectives have already been met or can not be met until the nonpoint source problem is solved. The author feels that America must keep economic realities in mind when planning future environmental goals. (Stump-Florida)  
W78-12565

**TOXIC POLLUTANTS CONTROL: PROGRESS AT LAST**, P. S. Ward.  
Journal Water Pollution Control Federation, Vol. 49, No. 1, p 6-9, January, 1977.

Descriptors: \*Administrative agencies, \*Industrial wastes, \*Pollutants, \*Pollution control, \*Federal Water Pollution Control Act, Administrative decisions, Chemical wastes, Regulation, Economic impact, Effluents, Environmental control, Feasibility, Federal government, Industries, Judicial decisions, Pollution abatement, Toxins, Waste disposal, Wastes, Water law, Water pollution, Water pollution sources.

The Environmental Protection Agency has experienced great difficulty in attempting to implement section 307a of the Federal Water Pollution Control Act (FWPCA), regarding toxic pollutant standards. This article discusses the adoption of a new enforcement policy which is designed to solve some of the problems engendered by section 307a. The new approach, spelled out in a covenant-approved consent agreement, generally calls for regulating toxic pollutants through other sections of the FWPCA, under the Nation Pollutant Discharge Elimination System permit mechanism. Regulation of toxic pollutants is thus tied to the best available technology requirements, which allow for a longer compliance period than does section 307a. The new plan also relaxes the structure of section 307a by allowing consideration of technological feasibility and economic impact factors; and, it permits regulation on an industry-by-industry, rather than pollutant-by-pollutant, basis. Section 307a will not be disregarded under the new approach, but will be applied only to extremely toxic pollutants requiring immediate regulation. The author examines the progressing development of standards under the new policy, and concludes that Congressional monitoring of the toxic effluent program will continue. (White-Florida)  
W78-12567

**PUBLIC INVOLVEMENT IN NATURAL RESOURCE DEVELOPMENT: A REVIEW OF WATER RESOURCE PLANNING**, Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Environmental and Urban Systems.  
For primary bibliographic entry see Field 6E.  
W78-12568

**BERKLEY V. STATE DEPARTMENT OF ENVIRONMENTAL REGULATION (CONSTRUCTION IN BISCAYNE BAY APPROPRIATE UNDER THE COMPREHENSIVE FLORIDA AQUATIC PRESERVE ACT)**.  
For primary bibliographic entry see Field 6E.  
W78-12571

**MINNEHAHA CREEK WATERSHED DISTRICT V. HOFFMAN (DEFINITION OF NAVIGABLE WATER UNDER THE RIVERS AND HARBORS ACT)**.  
For primary bibliographic entry see Field 6E.  
W78-12572

**FLORIDA ENVIRONMENTAL LAND AND WATER MANAGEMENT ACT**, Florida Environmental Land and Water Management Act.  
For primary bibliographic entry see Field 6E.  
W78-12583

**METROPOLITAN SEWERAGE DISTRICTS**.  
For primary bibliographic entry see Field 6E.  
W78-12584

**COUNTY WATER AND SEWER DISTRICT LAW**.  
For primary bibliographic entry see Field 6E.  
W78-12585

**NATURAL RESOURCES DEFENSE COUNCIL, INC. V. COSTLE (STANDARDS GOVERNING ISSUANCE OF NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM PERMITS)**.  
For primary bibliographic entry see Field 6E.  
W78-12587

**ENVIRONMENTAL DEFENSE FUND, INC. V. COSTLE (ADEQUACY OF ENVIRONMENTAL IMPACT STATEMENT FOR CONSTRUCTION OF OCEAN OUTFALL SERVERS IN LONG ISLAND, NEW YORK)**.  
For primary bibliographic entry see Field 6E.  
W78-12589

**PREDICTION OF ASSIMILATION CAPACITY IN SMALL RECEIVING STREAMS**, Oklahoma State Univ., Stillwater. School of Civil Engineering.  
For primary bibliographic entry see Field 5B.  
W78-12604

**DESIGN, COST ESTIMATION AND OPTIMIZATION OF SEWAGE COLLECTION AND TREATMENT SYSTEMS FOR HOUSING DEVELOPMENT IN THE GLENWOOD, NEW YORK AREA**, Calspan Corp., Buffalo, NY.  
For primary bibliographic entry see Field 5D.  
W78-12611

**THE ROLE OF 208 IN PLANNING GROUND-WATER USE**, Southern California Association of Governments, Los Angeles. R. J. Riga.  
In: Proceedings of the Eleventh Biennial Conference on Groundwater, September 15-16, 1977, Fresno, California, California Water Resources Center, University of California, Davis, Report No. 41, November, 1977. p 88-90.

Descriptors: \*California, \*Groundwater resources, \*Federal Water Pollution Control Act, \*Comprehensive planning, Groundwater resources, Local governments, Management, Wastewater treatment, Water pollution, Water quality control, Water quality standards, Pollution abatement.

Section 208 of the 1972 Federal Water Pollution Control Act provides for the development and implementation of areawide and statewide plans to control and prevent pollution. Section 208 will have little impact on presently adjudicated or nonadjudicated groundwater basins which have been operated for several years without adversely affecting water quality. In basins where overdrafts are occurring that result in water quality degradation and impairment of beneficial uses, it can be anticipated that regulatory programs requiring protective measures or restrictions of pumpage will be established. Some of the subject areas that can be anticipated in many Section 208 plans include: (1)



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

control of pollution from unsewered communities; (2) industrial waste disposal from inadequate lagoon or injection systems; (3) runoff quality management; (4) agricultural activities; (5) residual waste disposal; and (6) facilities siting. While groundwater quality standards are not a requirement of the Act, federal Environmental Protection Agency guidelines for Section 208 planning speak to their desirability. A Section 208 plan must specify the means by which the proposals it sets forth are to be financed and the schedule by which they are to be carried out. (See also W78-06039) (Jordan-Florida)  
W78-12616

**WATER RESOURCES AND HEALTH PROBLEMS IN DEVELOPING COUNTRIES (IN FRENCH).** Paris-7 Univ. (France). Dept. of Parasitology. For primary bibliographic entry see Field 5F.  
W78-12625

**UTILIZATION OF FISH AS INDICATORS OF WATER QUALITY: AND COMPARISON WITH THE BIOTIC INDEX METHOD: APPLICATIONS TO THE LAXIA RIVER IN THE FRENCH BASQUE REGION AND THE GABAS RIVER IN THE LANDES DEPARTMENT, (IN FRENCH).** Station d'Hydrobiologie Continentale, Biarritz (France). Lab. de Methodologie des Inventaires. For primary bibliographic entry see Field 5A.  
W78-12634

**CURRENT CONDITIONS AND INTENSITY OF SELF-PURIFICATION IN THE UPPER REACHES OF THE SUKHONA RIVER (IN RUSSIAN).** Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya. For primary bibliographic entry see Field 5C.  
W78-12654

**THE DISTRIBUTIVE EFFECTS OF PUBLIC LAW 92-500.** Northwest Missouri State Univ., Maryville. Dept. of Business and Economics. R. A. Collins. Journal of Environmental Economics and Management, Vol. 4, No. 4, p 344-354, 1977, 5 fig, 16 ref.

Descriptors: \*Income distribution, \*Economic impact, \*Government finance, \*Water pollution control, Tax burden, Waste water treatment plants, Biochemical oxygen demand, Industries, Legislation, \*Public Law 92-500, \*Clean Water Act, \*Subsidies, Title II Amendments, Benefit distribution.

Described are the distributive effects of the Title II 1972 Amendments to the Federal Water Pollution Control Act. This Act provides subsidies for the construction of publicly owned waste water treatment plants where the subsidies accrue partly to the municipalities and partly to certain industries. The author's intent is to estimate the potential effects of this federal subsidy program on the distribution of family income in EPA Region VII under the assumptions that the benefits accrue to the users of the treatment plants and that the tax burden is borne by the population of the study region in general. The author estimates the proportion of subsidies accruing to either the municipal or industrial sector and relates this subsidy to income groups. It is assumed that the municipal subsidy accrues to the various income classes of users of the treatment plants in proportion to their contribution to the treatment load. Since the total proportion of all industry that is connected to a municipal plant is rather small, it is unlikely that a large percentage of firms in any one industry will receive these large subsidies; it is assumed that these subsidies will accrue to the owners of the firms. The author concludes that most of the net benefits are received by the very rich. (Coan-NC)

W78-12655

**TANKERS AND OIL TRANSFER OPERATIONS ON THE DELAWARE RIVER AND BAY.** Comptroller General of the United States, Washington, DC. Report CED 77-124, August 23, 1977, 29 p.

Descriptors: \*Harbors, \*Delaware River, \*Water pollution control, \*Oil spills, Oil pollution, Regulation, Equipment, Standards, Channel improvement, Inspection, Navigation, \*Tankers, \*Delaware Bay, \*Oil transfer operations, Coast Guard.

During the calendar years 1973 through 1976, 180 oil tanker pollution incidents and 83 tanker casualties were reported on the Delaware River and Bay. Seven caused a discharge of more than 10,000 gallons of oil. The primary causes of the pollution incidents and the casualties were human error and equipment failure. In their examination of these incidents, the GAO determined that expanded requirements for navigational, steering, and pollution prevention equipment have the potential to reduce the incidents; proposed U.S. regulations and international efforts to improve standards should help reduce the incidents; maintenance of the channel and the navigation system currently in operation appear adequate while improvements suggested by the Pilots' Association regarding the aids to navigation and restrictions on the use of anchorages may have the potential to further reduce risks to vessels using the area; the project proposed by the Coast Guard to establish a secondary channel in the river has merit; and expansion of the inspection program should help improve the safety of tankships. In general, the GAO concluded that steps taken since January 1977, or currently under consideration, should improve the safety of tankers using this area. (Nessa-NC)  
W78-12656

**PROCEEDING OF ENVIRONMENTAL IMPACT STATEMENT CONFERENCE, HELD AT KANSAS CITY, MISSOURI ON 8-9 NOVEMBER, 1972.** Environmental Protection Agency, Kansas City, MO. For primary bibliographic entry see Field 6G.  
W78-12657

**DRAFT GUIDELINES FOR AREAWIDE WASTE MANAGEMENT PLANNING. SECTION 208, FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972.** Environmental Protection Agency, Washington, DC. Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 676. Price codes: A07 in paper copy, A01 in microfiche. May 3, 1974, (82 p).

Descriptors: \*Water Quality Act, \*Planning, \*Management, Land use, Methodology, Non-structural alternatives, Regulation, Water pollution, Water pollution control, Water pollution sources, \*Federal Water Pollution Control Act Amendments of 1972, Section 208, \*Areawide waste management planning, \*Nonpoint sources, Point sources, Guidelines.

The Federal Water Pollution Control Act Amendments of 1972 require the control of point and nonpoint sources of water pollution in order to meet the goals of the Act. Section 208 of the Act encourages areawide management planning in areas which, as a result of urban-industrial concentrations or other factors, have substantial water quality problems. Regulations have been published (40 CFR Part 126) on 208 area and agency designations and have been proposed (40 CFR Part 35, Subpart F) on 208 planning grant applications. This guideline presents an approach to planning for areawide waste management under Section 208.

The planning approach set forth in this guideline incorporates the basic planning features of problem identification, identification of management and technical constraints, identification of possible solutions to problems, alternative plan development, alternative plan analysis, selection of an areawide plan, and periodic updating of the plan. This guideline is intended to assist 208 planning agencies in carrying out their areawide waste management planning responsibilities. It also applies to other local, state, and federal agencies that may be involved in the planning process for those areas or in plan review procedures. (Nessa-NC)  
W78-12658

**PLAN AND CONCEPTS FOR MULTI-USE MANAGEMENT OF THE ATCHAFALAYA BASIN.** Coastal Environments, Inc., Baton Rouge, LA. For primary bibliographic entry see Field 6G.  
W78-12686

**WATER QUALITY PLANNING, AND OPPORTUNITY FOR CONSERVATION DISTRICT COMMISSIONERS.** Iowa Dept. of Soil Conservation, Des Moines. Conservancy District Div. W. Hauser, III. Journal of Soil and Water Conservation, Vol. 33, No. 3, p 102-103, January-February, 1978.

Descriptors: \*Water districts, \*Iowa, \*Water pollution control, \*Conservation, Legislation, Local governments, Soil conservation, Cost sharing, Water quality, Federal government, Adoption of practices, Planning.

Under section 208 of Public Law 92-500, nonpoint water pollution control planning still offers tremendous opportunities for soil conservation district commissioners throughout the United States. While the nonpoint plans are being completed, commissioners can exert much influence on future soil and water conservation policies. While erosion control programs are not to only answer to nonpoint water pollution problems, they can serve as useful guidelines in many respects. It is important that commissioners in each state know what parts of current district programs can effectively improve water quality. Iowa has been looked to as a state that has been able to use available resources to make contributions toward managing natural resource wisely and efficiently. Unfortunately, even programs in Iowa have not been 100 percent successful. Cost-sharing has been a limiting factor. Financing is not the only necessary component in a successful nonpoint pollution control plan. Other factors must be considered. Federal and state governments are turning to local districts to implement water quality plans. The time is now ripe for districts to take advantage of governmental support designed to put more responsibility for district policies and programs into commissioners' hands. (Spiegel-Florida)  
W78-12687

**ENVIRONMENTAL PLANNING FOR OFFSHORE OIL AND GAS - VOLUME III, EFFECTS ON LIVING RESOURCES AND HABITATS.** Conservation Foundation, Washington, DC. J. Clark, and C. Terrell. Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-77/14, March, 1978. 220 p, 53 fig, 30 tab, 176 ref.

Descriptors: \*Continental shelf, \*Oil fields, \*Water pollution control, \*Wildlife habitats, \*Assessments, \*Oil, Drilling, Oily water, Organic wastes, Water pollution treatment, Wetlands, Offshore platforms, Coastal structures, coasts, Outer Continental shelf, Offshore oil.

The potential effects are described of Outer Continental Shelf (OCS) development on living resources and habitats. Basic information is given for advance assessment of the effects of OCS oil and gas recovery on fish and wildlife resources and their supporting ecosystems. It encompasses offshore recovery operations, onshore facilities development, and the transport of raw and processed hydrocarbons. Ecological disturbances are described for the following OCS-related construction and operation subprojects: navigation improvement, piers, bulkheads, beach stabilization, site preparation, site development, artificial waterways and water bodies, roadways and bridges, groundwater supply, sewage systems, overland transmission systems, industrial cooling water systems, mosquito control, dikes-levees-impoundments, offshore and platform structures, marine transportation systems, and submerged transmission systems. A comprehensive review is provided of sources of ecological disturbance for OCS-related primary and secondary development. (Steiner-Mass)

W78-12697

# DOING SOMETHING ABOUT OIL SPILLS.

P. W. Quigg.

Sierra Club Bulletin, Vol. 62, No. 7, p 21-24, September, 1977.

Descriptors: \*Oil spills, \*Ships, \*Law of the sea, \*Sea water, Federal government, Oil pollution, Legislation, Environmental effects, Oceans, Foreign countries, Transportation, Standards.

The Carter Administration has taken a tough stance on safety standards for oil tankers. New regulations require double bottoms on tankers, segregated ballast, inert gas systems, backup radar systems, and improved emergency steering standards. These regulations will be applied to more ships than were older standards. The Intergovernmental Maritime Consultative Organization is now drafting a convention on crew standards and training. This is a crucial issue. President Carter has ordered the U.S. Coast Guard to inspect foreign tankers at least once a year. One highly favored bill in Congress provides for comprehensive liability and compensation for oil pollution damages. After these measures are adopted and enforced, four issues will still concern environmentalists. First is the Coast Guard, which to this point, has been incompetent. A second question is whether states may take protective action on their own. Increasing navigation technology and the right to intercept foreign-flag tankers are the third and fourth issues. The United States has threatened withdrawal from the Law of the Sea convention unless the United States' laissez-faire attitude toward deep-sea mining prevails. With so many important issues to be decided, no one would benefit from such an action. (Spiegel-Florida)

W78-12698

# MONTANA'S YELLOWSTONE RIVER: WHO GETS THE WATER.

For primary bibliographic entry see Field 6E.

W78-12699

# WATER QUALITY MISMANAGEMENT.

I. C. Nisbet.

Technology Review, Vol. 80, No. 7, p 10-11, June-July, 1978.

Descriptors: \*Federal water pollution control act, \*Water quality standards, \*Analysis, \*Regulation, \*Toxins, \*Pollutants, \*Permits, \*Waste treatment, \*Sewage treatment, \*Industrial wastes, \*Effluents, \*Management.

The major elements of the Federal Water Pollution Control Act (FWPCA) are listed, analyzed and the major flaws therein discussed. The author faults the FWPCA for emphasizing the construction of "conventional" types of municipal waste treatment

facilities, which is viewed as detrimental to various innovative features of the FWPCA—the provisions for regional planning, control of non-point source pollutions, technology-based effluent standards and regulation of toxic pollutants. The most conspicuous failure in the FWPCA has been its inability to regulate toxic pollutants. The federal Environmental Protection Agency (EPA) has provided minimum guidelines and funding. Planning authority has been delegated to local agencies because control of sources of pollution that are also bases of regional economies is a politically volatile issue. The author feels the EPA implemented the FWPCA in an incorrect order. This has encouraged unwise land development, promoted various private interests, imposed treatment standards for point sources unevenly, extended public exposure to hazardous pollutants, and frustrated the realization of national water quality goals. An alternative implementation scheme, and the reasons therefore, is presented. (Horwich-Florida)

# OIL AND GAS AND SULPHUR OPERATIONS IN THE OUTER CONTINENTAL SHELF.

Geological Survey, Washington, DC.

For primary bibliographic entry see Field 6G.

W78-12701

# HARMON COAL COMPANY V. DEPARTMENT OF ENVIRONMENTAL RESOURCES (REGULATION OF COAL STRIP MINE DRAINAGE OF ACIDIC WATER IN PENNSYLVANIA).

For primary bibliographic entry see Field 6E.

W78-12713

# TEN-YEAR LOW MEAN MONTHLY DISCHARGE DETERMINATIONS FOR UNGAGED STREAMS NEAR WASTE-STABILIZATION PONDS IN WISCONSIN.

Geological Survey, Madison, WI. Water Resources Div. S. J. Field.

Available from the National Technical Information Service, Springfield, VA 22161, as PB-284 266, Price Codes: A02 in Paper copy, A01 in Microfiche, Water Investigations 78-49, June 1978, 16 p, 3 fig, 6 tab, 3 ref.

Descriptors: \*Water quality control, \*Sewage lagoons, \*Effluents, \*Low flow, \*Streamflow, Discharge(Water), Ponds, Waste dilution, Low-flow frequency, Streamflow forecasting, Regression analysis, Wisconsin, \*10-year low mean monthly flow.

Communities in Wisconsin that use fill-and-draw waste-water treatment lagoons or waste-stabilization ponds are required to discharge during the spring and fall of the year at a rate that does not exceed the assimilative capacity of the receiving stream. The 10-year low mean monthly discharge (MMQ10) for October, November, April, and May for the receiving stream has been used to establish the discharge rate for the treatment systems at the appropriate time of the year. To determine the MMQ10 for the receiving stream the monthly mean discharge first was estimated by using a technique developed by Riggs (1969). Once the monthly mean discharge was determined the MMQ10 of the ungauged stream was estimated by using a graphical correlation between the monthly mean discharge and the MMQ10 of at least three gaging stations near the waste-stabilization pond. The MMQ10 for these gaging stations were determined by a log-Pearson Type III frequency analysis. The MMQ10 was determined for Maple Creek at Valmy, Allens Creek near Oakdale, North Branch Manitowoc River at Sherwood, East Fork Poplar River near Curtiss, and Yellow River at Barronette. (Woodard-USGS)

W78-12723

# AN EVALUATION OF PROBLEMS ARISING FROM ACID MINE DRAINAGE IN THE VICINITY OF SHASTA LAKE, SHASTA COUNTY, CALIFORNIA.

Geological Survey, Menlo Park, CA. Water Resources Div.

R. H. Fuller, J. M. Shay, R. F. Ferreira, and R. J. Hoffman.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 667, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 78-32, May 1978, 39 p, 5 fig, 7 tab, 19 ref.

Descriptors: \*Water pollution sources, \*Acid mine water, \*Mine drainage, \*Path of pollutants, \*Water pollution control, Copper, Iron, Zinc, Pyrite, California, \*Shasta County.

Streams draining the mined areas of massive sulfide ore deposits in the Shasta Mining Districts of northern California are generally acidic and contain large concentrations of dissolved metals, including iron, copper, and zinc. The streams, including Flat, Little Backbone, Spring, West Squaw, Horse, and Zinc Creeks, discharge into Shasta Reservoir and the Sacramento River and have caused numerous fish kills. The sources of pollution are discharge from underground mines, streams that flow into open pits, and streams that flow through pyritic mine dumps where the oxidation of pyrite and other sulfide minerals results in the production of acid and the mobilization of metals. Suggested methods of treatment include the use of air and hydraulic seals in the mines, lime neutralization of mine effluent, channeling of runoff and mine effluent away from mine and tailing areas, and the grading and sealing of mine dumps. A comprehensive preabatement and postabatement program is recommended to evaluate the effects of any treatment method used. (Woodard-USGS)

W78-12735

# PROGRESS REPORT ON BLACK MESA PROGRAM--1977.

Geological Survey, Tucson, AZ. Water Resources Div.

Open-file report 78-459, April 1978. 38 p, 5 fig, 8 tab.

Descriptors: \*Strip mines, \*Coal mines, \*Effects, \*Water quality, \*Water resources, Data: collections, Surface waters, Groundwater, Observation wells, Water levels, Aquifers, Streamflow, Sediment yield, Water chemistry, Indian Reservations, Arizona, \*Black Mesa.

Monitoring of coal mine operations on Black Mesa, Ariz., was started in 1971 to determine the effects of strip mining on water resources in the area. Monitoring on and near the mesa includes measurements of ground-water levels and quality and quantity, sediment concentration, and chemical quality of surface water. The surface-water monitoring consists of: (1) rainfall-runoff characteristics near the mine, and (2) surface-flow conditions and water-quality characteristics at Moenkopi Wash at Moenkopi. Three watersheds of about 400 acres each are instrumented for the collection of flow data, precipitation data, and water samples for determination of chemical quality and sediment concentration. Each watershed is equipped with a data-collection platform that transmits data via satellite to a computer that provides near-real time information ground-water withdrawal on the regional potentiometric surface in the aquifer on a continuing basis. The available data are insufficient to assess the effects of mining on the quantity, sediment concentration, or chemical quality of runoff. Water levels in seven wells have not shown significant declines but water levels in other wells have declined as much as 7 feet. (Woodard-USGS)

W78-12740

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

**URBAN STORM-WATER DATA MANAGEMENT SYSTEM, BROWARD COUNTY, FLORIDA.**  
Geological Survey, Bay St. Louis, MS. Water Resources Div. and Geological Survey, Miami, FL. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-12747

**COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, VOLUME 1: SUMMARY REPORT.**  
For primary bibliographic entry see Field 6B.  
W78-12760

**COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, APP. XI: WATER SUPPLY & WATER QUALITY CONTROL; APP. XII: OUTDOOR RECREATION; APP. XIII: FISH & WILDLIFE.**  
For primary bibliographic entry see Field 6B.  
W78-12765

**KING RESOURCES COMPANY V. BOARD OF ENVIRONMENTAL PROTECTION (PROCEDURE FOR CONSTRUCTION CERTIFICATION UNDER THE FEDERAL WATER QUALITY CONTROL ACT AFFIRMED).**  
For primary bibliographic entry see Field 6E.  
W78-12777

**BALANCE CONTROL WATER SCREEN, E. Forshee.**  
U.S. Patent No. 4,081,374, 5 p, 4 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 968, No 4, p 1458, March 28, 1978.

Descriptors: \*Patents, \*Water quality control, \*Water purification, \*Separation techniques, Water pollution, Flotsam, Jetsam, Filtration, Screens, Equipment.

An apparatus is used in separating trash or debris from fluid such as water. It includes a means for conveniently and readily separating foreign matter or trash from water so that clean, filtered water can pass or be directed to a desired location, and the trash or other foreign matter removed from the water can be conveyed to a separate location. The balance control water screen apparatus is simplified by having a flange handle device to improve the operation of the door flap, and provide the flat itself with an improved bearing system. (Sinha - OEIS)  
W78-12782

**FLOW STILLING DEVICE, Pro-Tech, Inc., Paoli, PA. (Assignee).**  
For primary bibliographic entry see Field 8B.  
W78-12784

**ACTIVATED CARBON AND PREPARATION THEREOF, Sumitomo Durez Co., Ltd., Tokyo (Japan). (Assignee).**  
For primary bibliographic entry see Field 5F.  
W78-12786

**END POINT QUALITY CONTROL LIGHT CIRCUIT, Continental Water Conditioning Corp., El Paso, TX. (Assignee).**  
C. L. Jones, and D. Aradio.  
U.S. Patent No. 4,082,666, 11 p, 5 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 969, No 1, p 270, April 4, 1978.

Descriptors: \*Patents, \*Deminceralization, \*Water quality control, \*Water treatment, \*Water purifi-

cation, Monitoring, Electronic equipment, Safety, Electric currents.

The quality control light circuit for a water demineralizer comprises a power cord, a housing for the electronics, and a probe-light assembly. The probe-light assembly includes a pair of spaced apart A.C. energized probes, and applies approximately 12 volts to the water. The probes are transformer isolated from the power input, and the final drive to an indicating lamp is transistorized. The current through the probes, directly proportional to the quality of the water, develops a voltage that is compared to a threshold voltage. The indicating lamp is illuminated to indicate high water quality, and is switched off by the final drive transistor when the water quality becomes unacceptable. An optional switching circuit, isolated from the quality control circuit, enables the actuation or control of external devices in dependence upon water quality. Various techniques for minimizing leakage currents are also disclosed. (Sinha-OEIS)  
W78-12788

**SEPARATOR OF OIL AND WATER, Barton Hydraulic Engineering Co. Ltd., Birmingham (England). (Assignee).**  
C. A. Bainbridge.  
U.S. Patent No. 4,082,669, 5 p, 2 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 969, No 1, p 271, April 4, 1978.

Descriptors: \*Patents, \*Water quality control, \*Water pollution treatment, \*Waste water treatment, Industrial wastes, Oil pollution, Oily water, Separation techniques, Flotation, Ballast water.

A separator for oil and water incorporates three separating stages through which oil and water mixture successively flows. The first stage comprises a series of plates over which the mixture flows in an upward direction. Oil in the mixture gathers on the surfaces of the plates and forms climbing films. These films move to the upper edges of the plates and form agglomerates. When the agglomerates are big enough for their buoyancy to overcome the surface tension holding them to the plates, they break away and float to a collecting zone. The second stage comprises a coagulator. Oil remaining in the water collects on the material in the coagulator bed which comprises finely divided material having a greater affinity for oil than water. Water leaving the plate separator filters up through the interstices of the coagulator bed while oil collects on the material of the bed forming climbing films which flow upwardly at a lower rate than the water and agglomerate above the bed. Water leaving the coagulator bed contains oil of molecular fineness which is removed by the screen of the third stage. Oil separated in the various stages collects in zones from which it can be removed, the clear water finally leaving the upper end of the separator. (Sinha-OEIS)  
W78-12789

**BUOY TYPE OIL GATE, F. J. Dalli.**  
U.S. Patent No. 4,082,674, 5 p, 5 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 969, No 1, p 273, April 4, 1978.

Descriptors: \*Patents, \*Water quality control, \*Oil pollution, Floating, Barriers, Buoyancy, Buoys, Channels, Variable water levels.

A buoy type oil gate straddles a stream having variable water levels. The gate is arranged to float so that it has an area extended above the water level and has ends which ride in and seal to channels next to the banks of the stream. The buoy type oil gate rides up and down within a pair of channels so that it has the capability of holding back oil from passing downstream of the gate. The gate is beveled to reduce the friction and allows for free movement with the stream. (Sinha - OEIS)  
W78-12790

**DIRT FILTER FOR WATER PIPES, V. Dulger.**  
U.S. Patent No. 4,082,676, 4 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 969, No 1, p 273, April 4, 1978.

Descriptors: \*Patents, \*Water quality control, \*Filtration, Separation techniques, Water conveyance, Pipes, Filters.

Water pipes of the type used for carrying water for household and industrial use have a dirt filter. The filter defines inlet and outlet chambers with an apertured dividing wall. An upper lid and a lower dirt collecting container are attached with threaded connections to the housing. A filter insert is placed between the lid and the dividing wall and has a carrier with upper and lower cylinder rings which respectively engage the lid and the chamber dividing wall. The interior of the filter has fluid communication with the inlet chamber through the opening in the chamber away from the interior of the dirt collecting container but permits dirt to drop into the container. (Sinha - OEIS)  
W78-12791

**TESTING SKIMMERS FOR OFFSHORE SPILLED OILS, H. W. Lichte, and M. K. Breslin.**  
In: Proceedings Tenth Annual Offshore Technology Conference, held in Houston, TX, May 8-11, 1978, Vol 1, p 247-254, 1978, 5 fig, 7 tab, OTC No. 3076.

Descriptors: \*Oil spills, \*Skimming, \*Testing, Water pollution, Pollution abatement, \*Outer Continental Shelf, Sea conditions, Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT).

The U.S. Environmental Protection Agency (EPA) began operation of a test facility in Leonardo, N.J., in 1974 to evaluate or develop spill cleanup methods and equipment without endangering the environment. The facility, Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT), is operated for the EPA by Mason and Hanger-Silas Mason Co., Inc. The U.S. Coast Guard, U.S. Navy (NAVFAC and CEL), Dept. of Energy, and EPA have all sponsored test programs either singly or jointly. This report describes, for spill-control equipment users and designers, a unique test facility providing reproducible, simulated environmental conditions where the 21 advancing oil skimmers examined for inclusion in this paper have been evaluated during the four years of the facility's operation. The mean throughput efficiency for those skimmers observed is 23%, for operations between zero and 3 m/s (6.0 kt) advancing speeds in 0.6 m (2 ft) sea conditions when collecting low viscosity oils similar to No. 2 fuel oil. Performance improves with lower seas and heavier oils. The tables and charts of this paper do not include data from tests that develop unusually low results due to high tow speeds or severe sea conditions. (Sinha-OEIS)  
W78-12804

**TRAINING AS A FACTOR IN OIL SPILL RESPONSE, D. A. Alberts, M. H. Philips, and D. Shea.**  
In: Proceedings Tenth Annual Offshore Technology Conference, held in Houston, TX, May 8-11, 1978, Vol. 1, p 255-260, 1978, 2 tab, 3 ref, OTC No. 3077.

Descriptors: \*Oil spills, \*Water pollution control, \*Training, Education, Pollution abatement, Resources development, \*Outer Continental Shelf.

A videotape Oil Spill Response Training Program has been developed by NUS Corporation in conjunction with Texaco Inc. to provide industry training for all levels of personnel in the areas of oil spill prevention, planning, and response. The



# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Water Quality Control—Group 5G

program consists of 23 1/2 hour color videotapes that integrate strong educational principles into the creative videotape medium. It is structured to permit the inclusion of specific material relative to any facility/installation, and is currently being used by both civilian and government agencies. This paper addresses the motivation behind and the methodology used in the development of the program. (Sinha-OEIS)  
W78-12805

**BEHAVIOR OF THE BOUCHARD NO. 65 OIL SPILL IN THE ICE-COVERED WATERS OF BUZZARDS BAY,**  
P. C. Deslauriers, and S. Martin.  
In: Proceedings Tenth Annual Offshore Technology Conference, held in Houston, TX, May 8-11, 1978, Vol. 1, p 267-276, 1978. 4 fig, 2 tab, 9 ref. OTC No. 3079.

Descriptors: \*Oil spills, \*Ice cover, \*Sea ice, \*Water pollution effects, \*Massachusetts, Pollution abatement, Resources development, Environmental effects, Weathering, \*Outer Continental Shelf, Buzzards Bay (MA).

Most of the present data on oil pollution in ice-covered waters has been obtained from spills in static ice conditions. Thus, the Buzzards Bay spill, which occurred in moving ice, was of particular interest. Initially, the strong tidal currents transported most of the oil leaking from the barge into the broken ice field and beneath the large ice floes. The oil then collected in the crack systems of the rafted ice, hummocks, pressure ridges, and leads, and occupied an area of about 0.1 sq km. Oil pools formed by the rafted ice contained up to 2,000 gal of pure oil. No. 1 oil that was incorporated in hummocks and ridges was not as concentrated. Some oil in concentrated areas spread onto the ice floe surface primarily by wind forces. The No. 2 oil weathered at different rates, ranging from 6 to 47 percent volume loss, depending upon the degree of oil exposed to the air. On Feb. 5, 0.1 m of snow fell at Buzzards Bay covering most of the oil from view; oil in concentrated pools formed a slush-like mixture containing 30% oil by volume. This snow greatly hindered aerial surveillance, research efforts, and cleanup attempts. Several cleanup techniques were used; the most successful was direct suction from concentrated pools into vacuum trucks accounting for nearly 13,000 gal of recovered oil. The ice began to break up around Feb. 8, releasing the oil contained in the ice in the form of a thin sheen. In addition, oily ice floes were transported by the currents through Cape Cod Canal into Cape Cod Bay, where they melted. These processes continued until about Feb. 26, 1977, when Buzzards Bay was essentially free of visible oil. (Sinha-OEIS)  
W78-12806

**ENVIRONMENTAL ASSESSMENT OF THE BUCCANEER OIL AND GAS FIELD OFF GALVESTON, TEXAS: AN OVERVIEW,**  
For primary bibliographic entry see Field 5C.  
W78-12807

**ASSESSMENT OF ENVIRONMENTAL IMPACT OF OFFSHORE PRODUCTION IN THE BUCCANEER OIL FIELD: SEDIMENTOLOGIC AND GEOCHEMICAL RESULTS,**  
Rice Univ., Houston, TX.  
For primary bibliographic entry see Field 5C.  
W78-12808

**OCEAN MINING AND PROTECTION OF THE MARINE ENVIRONMENT IN THE RED SEA,**  
Z. Mustaffi, and H. Amann.  
In: Proceedings Tenth Annual Offshore Technology Conference, held in Houston, TX, May 8-11, 1978, Vol. 2, p 1199-1214, 1978. 14 fig, 15 ref. OTC No. 3188.

Descriptors: \*Water pollution effects, \*Resources development, \*Environmental effects, \*Mining, Ecosystems, Pollutant abatement, \*Outer Continental Shelf, Deep-sea mining, Red Sea.

By all standards the Red Sea constitutes a unique marine environment. A highly diversified, rich and varying fauna and flora at the reef covered coasts and delicately organized pelagic life and benthos in deep graben waters combine with the yet largely unknown hydrography and the particular geology of a nascent ocean into an ecological system of great importance to the scientific community. This ecosystem is, at the same time, exposed to extreme natural influences: intensive sun irradiation, constant and hot winds, and subsequent evaporation with negligible inflow of terrestrial water and a reduced exchange of fresh ocean water over the southern sill at Bab el Mandab. Salinity and temperature of the water are thus higher and oxygen and nutrient contents are lower than in other seas of the world. This results in carefully balanced metabolisms of the ecosystem. New technologies such as ocean mining of the Red Sea metalliferous muds must be concerned with the environment and its safeguarding. With this understanding the Saudi Sudanese Red Sea Joint Commission has entrusted Preussag in 1976 with the technical development of occurrences of ore bearing muds (Zn, Cu, Ag) in the deep sea graben. A comprehensive program is being carried out: monitoring the deep sea and coastal environment and designing for their protection, test production and controlled redeposition of tailings and sediments in graben areas as well as beneficiation and metallurgy of the complex marine ores. A description of the task and preliminary results of recent research and development work until early 1978 are given together with an outlook on forthcoming steps. (Sinha-OEIS)  
W78-12809

**A CONCEPTUAL MODEL FOR RESPONSE TO ARCTIC OIL SPILLS,**  
Coast Guard Research and Development Center, Groton, CT.  
For primary bibliographic entry see Field 5B.  
W78-12818

**POLAR CONTINENTAL SHELF PROJECT. TITLES AND ABSTRACTS OF SCIENTIFIC PAPERS SUPPORTED BY PCSP.**  
Department of Energy, Mines and Resources, Ottawa (Ontario) Polar Continental Shelf Project.  
For primary bibliographic entry see Field 5C.  
W78-12819

**STUDY OF DETECTION, IDENTIFICATION, AND QUANTIFICATION TECHNIQUES FOR SPILLS OF HAZARDOUS CHEMICALS,**  
Battelle Pacific Northwest Labs., Richland, WA.  
For primary bibliographic entry see Field 5A.  
W78-12821

**AN OIL AND SORBENT MIXTURE CONTAINMENT BOOM.**  
Office of Naval Research, Arlington, VA.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A003 051, Price codes: A02 in paper copy, A01 in microfiche. U.S. Navy Case No. 58,515, Patent Serial No. 767,746, Filed 22 July 1976. 14 p, 3 fig.

Descriptors: \*Oil spills, \*Water pollution treatment, \*Equipment, Water pollution control, Oil pollution, \*Outer Continental Shelf, \*Oil booms, Containment.

A containment boom is described for containing a mixture of oil and sorbent floating on water. The boom comprises a series of interconnecting, rigid, solid barrier, having floats attached. The floats hold each rigid barrier vertically with respect to the surface of the water. A pair of porous screens are

attached to the top edge and the bottom edge of each rigid barrier. Each pair of porous screens lies in a plane with its corresponding rigid barrier. (Sinha-OEIS)  
W78-12823

**A RIGID, PERFORATED PLATE OIL BOOM FOR HIGH CURRENTS,**  
Shell Development Co., Houston, TX.  
R. R. Ayers.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 139, Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Agency, Environmental Protection Technology Series No. EPA-600/2-76-263, December 1976. 144 p, 35 fig, 5 tab, 7 append. EPA-68-03-0331.

Descriptors: \*Oil spill, \*Water pollution control, \*Equipment, Pollution abatement, Resources development, Currents (Water), Flow control, \*Outer Continental Shelf, \*Oil booms.

A boom capable of diverting oil spills toward shore in a 3-knot (1.5 m/s) river or tidal current has been developed. Loss of No. 2 and No. 4 Fuel Oil at this velocity is typically less than 15% when the angle of the boom is 45 degrees to the shoreline. In contrast, conventional booms lose this amount at only 1 knot (0.5 m/s). Good performance at high currents is achieved by placing a baffle upstream of a conventional flat plate boom. The baffle, an inclined, perforated plate, is used to create a flow-sheltered region where the oil layer thickens. A continuation of the inclined plate baffle forms the 'floor' of the sheltered region to control the flow rate of existing water. Horizontal plates immediately behind the baffle reduce water downflow. The boom is made up of 8-foot (2.4 m) long, rigid sections similar in plan view to a floating dock module. The length of the boom depends upon the number of modules pinned together side by side. Floating suction or sorbent rope collection devices may be used to remove accumulated oil from the flow sheltered region and increase capability. (Sinha-OEIS)  
W78-12824

**TESTS OF THE ARCTIC BOAT CONFIGURATION OF THE LOCKHEED CLEAN SWEEP OIL RECOVERY SYSTEM IN A BROKEN ICE FIELD,**  
ARCTEC, Inc., Columbia, MD.  
L. A. Schultz.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A032 832, Price codes: A05 in paper copy, A01 in microfiche. Coast Guard Office of Research and Development Report No. CG-D-108-76, March 1976. 86 p, 21 fig, 7 tab, 4 ref. DOT-CG-51487-A.

Descriptors: \*Oil spills, \*Ice cover, \*Arctic, \*Polar Region, \*Equipment, Testing, Water pollution control, Pollution abatement, Outer Continental Shelf, Arctic Boat Configuration.

Full size tests of the Arctic Boat configuration of the Lockheed Model R2003 Clean Sweep oil spill recovery device were made operating in a simulated Arctic environment incorporating freezing temperatures and ice infested waters. Tests were conducted in a broken fresh water ice field of moderate ice piece size with crude oil. The tests were directed towards the evaluation of the oil recovery performance of the Arctic Boat configuration in comparison to the performance obtained from the unmodified device in tests conducted for the U.S. Coast Guard. The test results indicated that the oil recovery performance as measured by oil recovery rate and throughput efficiency is improved in the case of the Arctic Boat configuration with little effect on oil recovery efficiency in comparison to the unmodified unit, assuming that a suitable method is developed for the recovery of oil contained within the throughput barrier region. This improvement in oil recovery performance is

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

not achieved without penalty however. The Arctic Boat configuration tested showed a tendency towards drum jamming, and a far greater tendency towards ice rafting than was the case for the unmodified device. The oil recovery performance tests also indicated that the performance of the unit is highly dependent upon operating conditions. (Sinha-OEIS)  
W78-12826

**OIL SPILL CLEAN UP USING A COTTON SORBENT.**  
Texas Tech Univ., Lubbock. Dept. of Chemical Engineering.  
J. E. Halligan, A. A. Ball, and G. F. Meenaghan.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A034 955. Price codes: A07 in paper copy, A01 in microfiche. Coast Guard Department of Transportation Report No. CG-D-63076, January 1976. 139 p., 28 fig., 18 tab., 12 ref., 2 append. DPT-CG-42557-A.

Descriptors: \*Oil spills, \*Pollution abatement, \*Water pollution control, Dispersion, Sorption, Outer Continental Shelf, Cotton wasties.

On June 1, 1974 a nineteen month study was initiated to develop a sorbent dispersal, retrieval, and disposal system using cotton wasties to combat oil pollution. A test program was conducted to develop the design data base required to evaluate the concept as well as the system components. Major variables studied included crude oil type, sorbent to oil weight ratios, sorbent contact time, removal efficiencies, squeezing techniques, disposal via incineration, and air pollution parameters. The culmination of this effort has shown that the concept of using cotton as an oil spill clean-up agent is viable and that the system as operated was capable of retrieving approximately 95% of the oil confronted for water velocities of 2 feet/sec. or less and dispersion ratios of 0.05, or greater, pounds of cotton/lb of oil. (Sinha-OEIS)  
W78-12827

**TESTS OF OIL RECOVERY DEVICES IN BROKEN ICE FIELDS, PHASE II.**  
ARCTEC, Inc., Columbia, MD.  
L. A. Schultz.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 748. Price codes: A09 in paper copy, A01 in microfiche. Coast Guard Office of Research and Development Report No. CG-D-55-76, January 1976. 171 p., 45 fig., 19 tab., 2 append.

Descriptors: \*Oil spills, \*Water pollution control, \*Ice cover, \*Equipment, Pollution abatement, Arctic, Water pollution effects, Resources development, Baseline studies, Testing, \*Outer Continental Shelf.

The results of tests conducted in broken ice cover with crude oil and No. 2 fuel oil of five oil spill recovery devices manufactured by Lockheed, Marco, Ocean Systems, JBF Scientific, and Oil Mop are summarized. Additional tests were conducted to determine the natural spill thickness of crude oil and No. 2 fuel oil in open water at low temperature and in broken ice cover. The spreading tests indicated that thin oils will spread to a very thin layer whether in open water or in broken ice cover. Heavy oils in broken ice cover will achieve a natural equilibrium thickness many times greater than the open water thickness due to the partial containment of the oil by the broken ice pieces. The oil recovery tests demonstrated that modifications made to the Lockheed and Marco devices did improve their performance when operating in broken ice cover. Tests conducted with the OSI, JBF, and Oil Mop units were more elementary in nature and did not incorporate modification of the devices for use in ice. (Sinha-OEIS)  
W78-12828

**MATERIALS FOR OIL SPILL CONTAINMENT BOOM.**  
Civil Engineering Lab. (Navy), Port Hueneme, CA.  
D. E. Brunner.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A026 139. Price codes: A03 in paper copy, A01 in microfiche. Technical Note No. TN-1440, June 1976. 32 p., 1 fig., 4 tab., 31 ref.

Descriptors: \*Oil spills, \*Water pollution control, \*Equipment, Materials testing, Resources development, Environmental effects, Pollution abatement, \*Outer Continental Shelf, Oil booms, Hazardous materials.

A study was recently conducted at the Civil Engineering Laboratory to investigate containment boom material requirements, which were defined and weighted in terms of their relative importance. When available, standard test procedures for use in evaluating each requirement were identified. Both substrate materials and coatings to be applied are discussed in this report. From the limited investigation, polyester was the most promising substrate material, followed by nylon. Chlorosulfonated polyethylene, polyurethane with a polyether base, chlorinated polyethylene, and poly(vinyl chloride) formulated with ultraviolet inhibitors are the most promising coating materials. One substrate and coating combination could not be identified as best because of the variation in material properties. (Sinha-OEIS)  
W78-12829

**INVENTORY OF WATER RESOURCES RESEARCH IN AUSTRALIA, 1976.**

Australian Water Resources Council, Canberra  
Dept. of National Resources.  
For primary bibliographic entry see Field 2A.  
W78-12833

**PUBLIC DRINKING WATER SYSTEMS UNDER THE FLORIDA SAFE DRINKING WATER ACT.**  
Fla. Admin. Code, Ch 17-22, secs 22.101 thru 22.114, (1978). 1 app.

Descriptors: \*Florida, \*Water quality standards, \*Water quality control, \*Potable water, Permits, Water treatment, Turbidity, Organic compounds, Inorganic compounds, Water sampling, Water analysis, Wells.

These regulations are promulgated to implement the requirements of the Florida Safe Drinking Water Act as well as to acquire primacy for the State of Florida under the federal Safe Drinking Water Act (SDWA). The national primary and secondary drinking water regulations are adopted where possible. Otherwise, additional regulations are created fulfilling state and federal requirements. Certain public water systems are excluded from coverage of the SDWA and the Florida law. Maximum contaminant levels or the treatment technique, as well as sampling and analysis requirements for the water within public water systems, are provided in the regulations. The contaminants regulated include organics, inorganics, turbidity, microbiological, radionuclides and other chemical contaminants. Requirements for construction, operation and maintenance of a public water system are set forth covering all aspects from collection through treatment, storage and distribution. The Department is required to implement a drinking water program and collect and verify reports from water suppliers. The procedure for public notification of imminent hazards is included, along with relevant forms to be used in the enforcement of the regulations. (Quarles-Florida)  
W78-12836

**POLLUTION OF WATERS.**

Florida State Dept. of Environmental Regulation, Tallahassee.

For primary bibliographic entry see Field 6E.  
W78-12837

**VARIABILITY OF ANNUAL NUTRIENT AND SEDIMENT DISCHARGES IN RUNOFF FROM OKLAHOMA CROPLAND AND RANGELAND.**  
Agricultural Research Service, Durant, OK. Water Quality Management Lab.

R. G. Menzel, E. D. Rhoades, A. E. Olness, and S. J. Smith.  
Journal of Environmental Quality, Vol. 7, No. 3, p 401-406, 1978. 4 fig., 4 tab., 22 ref.

Descriptors: \*Oklahoma, \*Fertilizers, \*Nutrients, \*Agricultural runoff, \*Sediment yield, \*Water quality, Nitrates, Agricultural chemicals, Water pollution sources, Nitrogen compounds, Nitrogen, Phosphorus, Soil properties, Water pollution, Rainfall, Soil erosion, Sediments, Pollutants, \*Soluble nutrients.

Nitrogen and phosphorus discharges in runoff from nearly level cropland and 3% sloping rangeland were measured from July 1972 to June 1976. Sediment discharges and runoff amounts from these 5- to 18-ha watersheds were measured from July 1966 to June 1976. Sediment and nutrient discharges varied greatly from year to year and between different land uses. It was concluded that long records are needed to compare discharges from different management practices. The average and maximum annual sediment discharges, respectively, were 3,600 and 8,900 kg/ha from irrigated cotton, 900 and 3,900 kg/ha from dryland wheat, 400 and 1,800 kg/ha from range with limited grazing, and 9,000 and 23,000 kg/ha from overgrazed range. Maximum annual sediment discharges occurred during the period in which nutrient discharges were measured. Maximum annual nutrient discharges were 13 kg/ha total N, 4 kg/ha nitrate N, 11 kg/ha total P, and 2 kg/ha soluble P. The average annual discharge for each nutrient form and land use was about half of its maximum value. Nitrate accounted for 10 to 30% of the total N discharged. Soluble phosphate accounted for about 20% of the total P discharged from cropland, and less than 10% of that discharged from rangeland. Annual deposition in rainfall averaged 5 kg/ha N and 0.15 kg/ha P. (Henley-ISWS)  
W78-12858

**SIERRA CLUB V. BERGLAND (FEDERAL AGENCY FINDING OF SUDDEN IMPAIRMENT OF WATERSHED CHANNEL REVERSED).**  
For primary bibliographic entry see Field 6E.  
W78-12862

**ELWOOD V. CITY OF NEW YORK (LIABILITY FOUND FOR POLLUTION DAMAGES TO PROPERTY CAUSED BY DIVERSION OF HEADWATERS OF DELAWARE RIVER).**  
For primary bibliographic entry see Field 6E.  
W78-12871

**ALTERNATIVE POLLUTION CONTROL STRATEGIES: EQUITY, EFFICIENCY AND INFORMATION REQUIREMENTS.**  
Tennessee Univ., Knoxville. Dept. of Economics.  
H. W. Herzog, Jr.  
The Annals of Regional Science, Vol. 11, No. 3, p 1-20, 1977. 1 fig., 3 tab., 21 ref.

Descriptors: \*Water pollution control, \*Equity, \*Alternative planning, \*Patuxent River(MD), \*Model studies, \*Pollution taxes(Charges), Economics, Effluents, Economic efficiency, River basins, Waste water treatment, Maryland, Environmental control, Water management(Applied), Costs, Water quality standards, Regulation, Rivers.

A water quality management simulation of the Patuxent River Basin (Maryland) documented relative efficiency and equity of alternative ef-

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# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Water Quality Control—Group 5G

fluent tax programs designed to provide second-best solutions to the water quality problem for various levels of treatment centralization. Although the efficiency gain from information availability was impressive, specific recommendations regarding program merit must await further assessment of information, administration, and transaction costs of the various tax programs. Even less can be said about program equity, though the study indicated that all dischargers within the basin would prefer efficient to nonefficient effluent tax programs. While results from the Patuxent Basin cannot be generalized in any way, the system of progressive movement from lesser to more efficient programs lends itself well to basins currently lacking detailed treatment cost and hydrologic information. As national expenditures for pollution control will probably never exceed 2.5% the burden will be modest at this level. However, the distribution of this responsibility among regions and economic activities will not impose equal hardships on all waste dischargers, and little substantive information is available on the distributional aspects (equity) of environmental controls. The 'water quality problem' as defined in this paper is the difficulty of maintaining water quality within a river and assigning waste treatment responsibility. (Lynch-Wisconsin)

W78-12875

**ECONOMIC ASPECTS OF THE EFFECTS OF POLLUTION ON THE MARINE AND ANADROMOUS FISHERIES OF THE WESTERN UNITED STATES OF AMERICA.** Food and Agriculture Organization of the United Nations, Rome (Italy). Dept. of Fisheries. F.J. Hester. FAO Fisheries Technical Paper No. 162, 1976. 34 p, 1 fig, 17 tab, 14 ref.

Descriptors: \*Water pollution effects, \*Economic impact, \*Fisheries, \*Commercial fishing, \*Pacific Coast region, \*Pollutants, Marine fisheries, Anadromous fish, Economics, Productivity, Pacific Northwest U.S., California, Alaska, Washington, Hawaii, Oregon, Puget Sound, Columbia River, Aquaculture, Estuaries, Public health, Poisons, Habitats, Natural resources, Fish management.

This study examines direct and indirect costs of pollution as it affects yield and marketability of marine and anadromous fishery resources of the West Coast of the United States and associated tropical Pacific Ocean areas. Both conventional fisheries and aquaculture are considered. Two types of pollution are recognized: (1) addition of detrimental substances to the aquatic environment; and (2) physical loss or damage of aquatic habitat or mechanical destruction of organisms. A summary table presents major Type I and II pollutant inputs by location, with economic losses. It is concluded that: (1) poor management and natural population fluctuations have more influence on resources than does pollution; (2) BOD pollution is not a major factor in open waters; (3) Type II pollution, especially habitat loss, is more damaging than toxicants; and (4) Type I pollutants have caused more production losses from the threat to public health than from direct effects on resources. The study area comprises Alaska, Washington, Oregon, California, Hawaii, American Samoa and Guam, and the Trust Territory of the Pacific Islands. Eight Type I pollutants are considered: (1) trace heavy metals; (2) petroleum hydrocarbons; (3) chlorinated organic compounds; (4) sewage effluent and sludge, nutrients, pathogens, and BOD; (5) sediments; (6) fish processing wastes; (7) dumping wastes (including dredging spoils); and (8) electric power generation. (Lynch-Wisconsin)

W78-12876

**A NOTE ON THE USE OF PROPERTY VALUES IN ESTIMATING MARGINAL WILLINGNESS TO PAY FOR ENVIRONMENTAL QUALITY.** Handelshögskolan i Stockholm (Sweden).

M. Karl-Goran.

Journal of Environmental Economics and Management, Vol. 4, No. 4, p 355-369, 1977. 3 fig, 11 ref.

Descriptors: \*Social values, \*Willingness to pay, \*Property values, \*Damage functions, \*Pollution abatement, \*Analytical techniques, Economics, General equilibrium models, Model studies, Environmental effects, Social aspects.

Underlying theoretical assumptions for using property values in estimating damage function are demonstrated as unrealistic, showing that such values alone cannot give viable estimates of marginal willingness to pay for environmental quality. In the first part of the paper a general equilibrium model (hedonic price model) is constructed in which environmental quality differences are capitalized into land rents, and in the second part some assumptions needed for this result are scrutinized and found untenable. The first such assumption is that there exists a continuum of individuals who will tend to locate in homogeneous communities having similar environmental quality, amenities, and prices. If the communities are not homogeneous, then property values do not reflect willingness to pay for environmental quality for all individuals. Assuming a continuum of households may be a good approximation if the urban study area is large enough, but it is shown that there is no direct relationship between relative land rents and marginal willingness to pay. The points made in this paper fall into two categories: (1) those that show there is no reason why willingness to pay should be related in any simple way to the influence on property values from environmental quality differences; and (2) those concerned with specification of empirical relation. (Lynch-Wisconsin)

W78-12879

**THE EFFECTS OF POLLUTION TAXATION ON THE PATTERN OF RESOURCE ALLOCATION: THE DOWNSTREAM DIFFUSION CASE.** Tel Aviv Univ. (Israel).

E. Hochman, D. Pines, and D. Zilberman. Quarterly Journal of Economics, Vol 91, No 4, p 625-638, November 1977. 4 fig.

Descriptors: \*Resource allocation, \*Model studies, \*Pollution taxes (Charges), \*Downstream diffusion, \*Externalities, \*Water pollution effects, Economics, Diffusion, Effluents, Industrial wastes, Agriculture, Rent, Land use, Social impact, Air pollution, Optimization.

Two models are used to analyze effects of externalities—specifically effluent from an upstream firm damaging the product of a downstream firm—on land utilization and rent along a water or air stream. Characteristics of resource allocation and the corresponding price system with and without pollution taxes are discussed. The first model assumes that only an urban center downstream suffers from the pollutants, while the second focuses on damage done to downstream agricultural producers. In the first model a pollution tax reduces land values, output, and pollution level at each location; without taxation the competitive system results in rent and labor-intensity functions that decrease with distance from the urban center. The optimum system, with a decreasing tax-distance function, may change these patterns, resulting in increasing labor intensity and rent with distance at some segments close to the urban center. In the second model downstream producers enjoy low transportation costs but suffer relatively heavy pollution damage which may result in increasing segments of the rent-distance function near the urban center. In contrast with the first model, support by optimal taxation results in restoration of a monotone-decreasing, rent-distance function. The analysis deals with an industry operating in a competitive system whose share in the market is relatively small so that product and factor prices are given. (Lynch-Wisconsin)

W78-12880

**WATER TREATMENTS IN TRICKLE IRRIGATION SYSTEMS.** Agricultural Research Service, Phoenix, AZ. Water Conservation Lab. R. S. Nakayama, R. G. Gilbert, and D. A. Bucks. Journal of the Irrigation and Drainage Division, (ASCE), Vol. 1054, No. IR1, p 23-34, March, 1978. 11 fig, 1 tab, 12 ref.

Descriptors: \*Irrigation practices, \*Irrigation engineering, Filtration, Water treatment, Colorado River, Trickle irrigation, Return flow, Arizona.

Trickle irrigation has great potential in arid regions, by reducing the amount of water lost through evaporation as well as the amount of saline drainage return flow. A two-year study of trickle irrigation systems on the Colorado River in southwestern Arizona showed that adequate water filtration is a primary requirement for reliable emitter operation. For long-term operation of the trickle system, the accumulation of sediments, precipitates and microbial slime must be controlled by the practice of flushing mains, sub-mains, and lateral lines and by chemical water treatment. Emitters, line materials, and other equipment should be resistant to chemicals that may be injected into the system. (Russell-Arizona)

W78-12920

**EFFECT OF SALINITY ON AGRICULTURE IN IRAQ.** Mosul Univ. (Iraq). Coll. of Engineering. M. At-Layla.

Journal of the Irrigation and Drainage Division, (ASCE), Vol. 104, No. IR2, p 195-207, June 1978. 3 tab, 2 fig, 3 ref.

Descriptors: \*Salinity, \*Saline soils, \*Saline water, Irrigation water, Irrigation practices, Water management (Applied), \*Drainage, Iraq.

Primarily an agricultural country, Iraq's major soil problem is that of salt accumulation aggravated by poor irrigation practices. Discharge of drainage water from reclamation projects into the Euphrates and Tigris Rivers creates problems for municipal and agricultural uses, and should be re-routed to the low marshes of the south to protect the rivers' water quality. Agricultural extension services should be strengthened to indoctrinate farmers through better irrigation practices. (Russell-Arizona)

W78-12922

**SELECTED IRRIGATION RETURN FLOW QUALITY ABSTRACTS, 1975, FIFTH ANNUAL ISSUE.**

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering. G. V. Skogerboe, S. W. Smith, and W. R. Walker. Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 921. Price codes: A12 in paper copy, A01 in microfiche. Publication No. EPA-600/2-77-094, May, 1977. 249 p.

Descriptors: Fertilizers, Irrigated land, Irrigation systems, \*Irrigation water, Nitrates, Phosphates, \*Return flow, Salinity, Water pollution effects, \*Water pollution sources, \*Water quality control, \*Abstracts.

Research related to the quality of irrigation return flow is being conducted at numerous institutions throughout the western United States. Related work is also underway at other institutions in the United States, as well as other portions of the world. Approximately 100 sources of material have been searched for articles pertinent to the National Irrigation Return Flow Research and Development Program. These articles describe water quality problems resulting from irrigated



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

agriculture, potential technological solutions for controlling return flows, recent research pertinent to return flow investigations, and literature associated with institutional constraints in irrigation return flow quality control. The first annual issue of **SELECTED IRRIGATION RETURN FLOW QUALITY ABSTRACTS** covered publications printed in 1968 and 1969, while the second annual issue lists publications printed in 1970 and 1971, the third annual issue covers calendar years 1972 and 1973, and the fourth annual issue covers literature published in 1974. This annual issue lists publications printed in 1975. This report was submitted in fulfillment of Grant Number R-800426 under the sponsorship of the Office of Research and Development, Environmental Protection Agency. (Skogerboe-Colorado State) W78-12933

**IRRIGATING ON THE DEAD LEVEL,**  
U.S. Water Conservation Lab., Phoenix.  
For primary bibliographic entry see Field 3C.  
W78-12935

**EVALUATION OF THE MAGNITUDE AND SIGNIFICANCE OF POLLUTION FROM URBAN STORM WATER RUNOFF IN ONTARIO,**  
American Public Works Association, Chicago, IL.; and Florida Univ., Gainesville.  
For primary bibliographic entry see Field 5B.  
W78-12946

**REVIEW OF CANADIAN MUNICIPAL URBAN DRAINAGE POLICIES AND PRACTICES.**  
Gore and Storrie Ltd., Toronto (Ontario).  
Canada-Ontario Agreement on Great Lakes Water Quality, Environmental Protection Service, Fisheries and Environment, Canada, Ottawa, Canada; Pollution Control Branch, Ontario Ministry of Environment, Toronto, Ontario, Canada, Research Report No. 82, 1978. 54 p, 10 fig, 13 ref, 5 tab. 76-8-40.

Descriptors: \*Urban drainage, \*Sewers, \*Sewerage, \*Pollution abatement, Overflow, Flooding, Storm water, Storm runoff, Analytical techniques, Mathematical models, On-site investigations, Data collections, Computer programs, \*Canada.

Canadian municipal urban drainage practices are summarized, based on information supplied to Environment Canada from provincial and municipal agencies, supplemented by information obtained from a number of consulting engineers across Canada. The summary is presented in three parts: - Design of new sewer systems - Abatement of pollution due to combined sewer overflows - Field studies of sewer systems. Many of the problems associated with the quantity of flow aspect of urban drainage, such as basement flooding, have long been apparent to most municipal engineers. There is now an increasing awareness by regulatory bodies of the qualitative effects of urban drainage on receiving waters. At the municipal level, attention is being given to the new storm water management techniques for solving quantity and quality problems through storage and treatment of storm water flows. Mathematical simulation models are being used for analyses of municipal urban drainage systems. There is still much work to be done, however, in collecting background data and refining and calibrating the computer programs in order to obtain the closest relationships with actual conditions. Research and development projects on urban drainage problems are being sponsored at the federal and provincial levels and are providing additional knowledge pertinent to Canadian conditions, and considerable impetus to the application of storm water management techniques all across Canada. (WATDOC) W78-12949

**STATISTICAL CONSIDERATIONS IN PLANNING AQUATIC BIOASSAYS,**  
Canada Centre for Inland Waters, Burlington (Ontario).  
For primary bibliographic entry see Field 5A.  
W78-12954

**PREVENTIVE MEDICINE IN FISH DISEASES AND ENVIRONMENTAL ASPECTS OF TROUT FARMING,**  
Royal Veterinary and Agriculture Coll., Copenhagen (Denmark).  
For primary bibliographic entry see Field 5C.  
W78-12990

## 6. WATER RESOURCES PLANNING

### 6A. Techniques Of Planning

**EVALUATING AQUACULTURAL USE OF THERMAL EFFLUENTS: AN APPLICATION OF SYSTEM DYNAMICS TO ENVIRONMENTAL PROBLEM SOLVING,**  
Rhode Island Univ., Narragansett. Coll. of Business Administration.  
For primary bibliographic entry see Field 5G.  
W78-12196

**POLLUTION CONTROL IN A SIMPLIFIED GENERAL-EQUILIBRIUM MODEL WITH PRODUCTION EXTERNALITIES,**  
Kansas Univ., Lawrence. Dept. of Economics.  
For primary bibliographic entry see Field 5G.  
W78-12198

**REAL TIME CONTROL OF STORAGE IN A COMBINED SEWER SYSTEM,**  
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5D.  
W78-12286

**ANALYTICAL FRAMEWORK FOR THE DESIGN OF DATA COLLECTION SYSTEMS THAT ARE RESPONSIVE TO THE NEEDS OF PLANNING AND MANAGEMENT OF WATER RESOURCES AND RELATED LAND SYSTEMS,**  
Case Western Reserve Univ., Cleveland, OH. Systems Engineering Div.  
Y. Y. Haimes, J. Craig, and J. Subrahmanian.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 919. Price codes: A14 in paper copy, A01 in microfiche. Completion Report, May 1978. 276 p, 34 fig, 41 tab, 4 append. OWRT C-6027(No. 5202)(1).

Descriptors: \*Systems analysis, \*Data collections, Management, Planning, \*Analytical techniques, \*Cost analysis, \*Dynamic programming, Water demand, Water supply, \*Stream flow data, \*Optimum development plans, Land use, Capacity expansion, Water shortage.

In the first part of the report, a decomposition approach is proposed for the optimal sequencing of water supply projects constructed to meet a projected demand function. Efficient solution procedures based upon dynamic programming principles have been developed to select that sequence of projects which satisfies the demand for water at minimum cost; however, the requirements of such methods in terms of computational storage and time in general limits their application. A procedure based upon decomposition, dynamic programming, and incremental cost considerations is developed to permit effective analysis of systems, previously considered dimensionally infeasible. The method results in a substantial reduction of computational time requirements, while maintaining a high degree of accuracy in achieving

the optimal solution. With the problem of dimensionality eliminated, the procedure may be applied to a variety of real water resource problems. Examples illustrated include the optimal expansion for a large regional system and the consideration of demand functions for multiple water qualities. In the second part, a methodology is presented for determining the worth of stream flow data used to estimate future yields of proposed water supply projects. The worth of any particular number of years of stream flow data is measured in terms of water shortages and opportunity losses expected to be incurred, if values of project yields estimated from that body of data are used in planning for capacity expansion of the water supply system. The capacity expansion model developed in the first part and a sampling technique are used to generate penalty matrices corresponding to different numbers of years of stream flow data. Values of expected penalties are extracted from these matrices and are used as measures of worth. Noncommensurable functions of water shortage and cost are then determined, and the Surrogate Worth Tradeoff method is used to obtain an optimal value for the number of years for which stream flow should be collected in order to minimize the two noncommensurable penalties. The third part of the report is devoted to a case study in which the worth of stream flow data is determined with respect to capacity expansion of a system consisting of six candidate projects. W78-12388

**SYSTEMS ENGINEERING IN WATER RESOURCES DEVELOPMENT,**  
Technion - Israel Inst. of Tech., Haifa.  
N. Buras.  
Conference on resources of Southern Africa today and tomorrow, (Johannesburg) South Africa, p 227-233, September 22-26, 1975. 5 ref.

Descriptors: \*Systems engineering, \*Water resources development, Model studies, Regional development, \*South Africa.

Water resource systems tend to be nuclei around which other development activities concentrate - eg. Hydropower generation, irrigated agriculture, mining operations and locations of industries. In developing water resources engineers are confronted with various practical problems and by making use of systems engineering are able to analyse these problems, understand them and sometimes to find solutions. The objectives are, usually (1) economic - such as economic efficiency or the improvement in the balance of payment of the region or (2) social - such as redistribution of income, or maintaining a certain level of employment. Systems engineering is a powerful analytical tool and an important instrument in the hands of the water resources engineer in the discharge of his social responsibilities. (So Afr Water Info Ctr) W78-12420

**PREPARATION OF OUTLINE PLANS FOR THE DEVELOPMENT OF THE SURFACE WATER RESOURCES OF RHODESIA,**  
P. M. Gizic.  
Rhodesia Science News, (Salisbury), Vol 11, No 6, p 133-134, 1977.

Descriptors: \*Water resources development, Surface waters, Future planning, Rivers, Dam construction, Water utilization, \*Rhodesia, Africa.

The basic reason for any planning is to try to meet, in advance, the requirements of the future. In many instances there is a somewhat uncertain future and projections into the future are often difficult and sometimes well nigh impossible. To have any hopes of success, plans for the future must be formulated taking into account all known information - information on past trends and performance, the current position, known information on future development, and this must be combined with a degree of intuitive crystal-gazing. Despite this,

## WATER RESOURCES PLANNING—Field 6

### Techniques Of Planning—Group 6A

because we are planning for an uncertain future, it is essential that any plans have a degree of built-in flexibility to cater for changed circumstances. The more longterm a particular plan is, the more flexible it must be. (So Afr Water Info Ctr)  
W78-12477

**EFFECT OF STOCHASTIC MODEL CHOICE ON HYDRAULIC DESIGN,**  
Water Resources Center, Budapest (Hungary).  
For primary bibliographic entry see Field 8B.  
W78-12527

**APPLICATION OF STOCHASTIC MODELS TO RESERVOIRS NEAR THE ALPS,**  
Technische Univ., Munich (West Germany). Inst. for Hydraulics and Hydrology.  
For primary bibliographic entry see Field 4A.  
W78-12529

**A STOCHASTIC OPTIMIZATION MODEL OF THE LECH RI VER SYSTEM,**  
Technische Univ., Munich (West Germany). Inst. for Hydraulics and Hydrology.  
For primary bibliographic entry see Field 4A.  
W78-12530

**MULTIPURPOSE RESERVOIR OPERATION USING STOCHASTIC TRADE-OFF ANALYSES,**  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 4A.  
W78-12531

**RIVER WATER QUALITY MODELLING: A COMBINED DETERMINISTIC-STOCHASTIC APPROACH,**  
Utah State Univ., Logan. Coll. of Engineering; and Utah Water Research Lab., Logan.  
For primary bibliographic entry see Field 5B.  
W78-12532

**CHOICE BETWEEN RIVER QUALITY MODELS OF DIFFERENT DEGREES OF COMPLEXITY,**  
Nuclear Research Center, Karlsruhe (West Germany). Div. of Applied Systems Analysis.  
For primary bibliographic entry see Field 5B.  
W78-12533

**ON THE OPTIMIZATION TASK FOR WATER QUALITY MANAGEMENT,**  
Institute of Meteorology and Water Management, Wrocław (Poland).  
For primary bibliographic entry see Field 5G.  
W78-12534

**SYSTEM DEVELOPMENT OF WATER RESOURCES AND WATER QUALITY CONTROL,**  
National Water Authority, Budapest (Hungary).  
For primary bibliographic entry see Field 5G.  
W78-12536

**WATER QUALITY MODELLING IN SURFACE WATER NETWORKS WITH SPECIAL REGARD TO QUALITY BREAKDOWNS,**  
Institut fuer Wasserwirtschaft, Berlin (East Germany).  
For primary bibliographic entry see Field 5B.  
W78-12537

**A SIMPLE MATHEMATICAL MODEL OF QUANTITATIVE AND QUALITATIVE PROCESSES OCCURRING IN THE STREAM CHANNEL FOR WATER DISTRIBUTION CONTROL,**  
Institute of Meteorology and Water Management, Krakow, Poland. Krakow Div.  
W78-12538

For primary bibliographic entry see Field 5G.  
W78-12538

**COMPUTER PREDICTION OF THE CHANGES IN RIVER QUALITY REGIMES FOLLOWING LARGE SCALE INTER BASIN TRANSFERS,**  
Department of the Environment, Reading (England). Central Water Planning Unit.  
For primary bibliographic entry see Field 5B.  
W78-12539

**WATER RESOURCES MANAGEMENT USING INTEGER PROGRAMMING MODELS,**  
Utah State Univ., Logan. Coll. of Engineering.  
For primary bibliographic entry see Field 5G.  
W78-12540

**WATER QUALITY MODELLING AS A TOOL FOR DECISION MAKING IN HUNGARY,**  
Research Inst. for Water Resources Development, Budapest (Hungary).  
For primary bibliographic entry see Field 5G.  
W78-12541

**ASSESSMENT TECHNIQUES FOR MODELLING WATER QUALITY IN A RIVER BASIN IMPACTED BY COAL RESOURCE DEVELOPMENT,**  
Geological Survey, Denver, CO.  
For primary bibliographic entry see Field 5B.  
W78-12542

**OPTIMIZATION OF LONG-TERM SEQUENTIAL PROGRAMMES OF WATER QUALITY CONTROL,**  
Technical Univ. of Budapest (Hungary). Inst. for Water Management and Hydraulic Construction.  
For primary bibliographic entry see Field 5G.  
W78-12543

**OPTIMIZATION OF TECHNOLOGICAL PARAMETERS IN AN ACTIVATED SLUDGE SYSTEM AS A FUNCTION OF THE REQUIRED WATER QUALITY UNDER VARIABLE CONDITIONS,**  
Institute of Meteorology and Water Management, Warsaw (Poland).  
For primary bibliographic entry see Field 5D.  
W78-12544

**OPTIMAL PLANNING OF REGIONAL WASTE WATER TREATMENT,**  
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5D.  
W78-12545

**REGIONALIZATION AND STAGING OF WASTE WATER TREATMENT PLANTS TO MEET WATER QUALITY STANDARDS,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5D.  
W78-12546

**SOME PHYSICAL AND ECONOMIC ASPECTS OF OPTIMIZATION OF THE DEGREE OF WASTE WATER AND WATER TREATMENT,**  
Technical Univ. of Warsaw (Poland). Inst. of Water Supply and Hydrotechnics.  
For primary bibliographic entry see Field 5D.  
W78-12547

**ON THE COBB-DOUGLAS FUNCTIONS IN MULTIOBJECTIVE OPTIMIZATION,**  
Technion - Israel Inst. of Tech. Haifa. Faculty of Industrial and Management Engineering.  
U. Passy.  
W78-12548

Water Resources Research, Vol. 14, No. 4, p 688-690, August 1978. 19 eqs, 6 ref.

**Descriptors:** \*Optimization, \*Analytical techniques, \*Cobb-Douglas functions, \*Multiojective programming, \*Pareto solutions, Lagrangian multiplier, Costs, Projects, Water resources, Reservoirs, Equations, Systems analysis.

Properties of Pareto optimum solutions of multiojective problems with Cobb-Douglas production-type functions have been analyzed. This type of production function is used widely in economic theory and is therefore used in the related literature on water resources. It has been found that under the defined conditions, every feasible point is a Pareto solution. A numerical example is given, where capital cost of a project, water cost due to evaporation, and total volume capacity of a reservoir are considered. (Bell-Cornell)  
W78-12553

**DESIGN, COST ESTIMATION AND OPTIMIZATION OF SEWAGE COLLECTION AND TREATMENT SYSTEMS FOR HOUSING DEVELOPMENT IN THE GLENWOOD, NEW YORK AREA,**  
Calspan Corp., Buffalo, NY.  
For primary bibliographic entry see Field 5D.  
W78-12611

**DISCOUNTED FLOOD RISKS IN LEAST-COST DESIGN OF STORM SEWER NETWORKS,**  
Illinois Univ. at Urbana-Champaign. Dept. of Civil and Ceramic Engineering.  
For primary bibliographic entry see Field 5D.  
W78-12612

**TESTING AN ITERATIVE, OPEN PROCESS FOR WATER RESOURCES PLANNING,**  
Stanford Univ., CA. Dept. of Civil Engineering. T. P. Wagner, and L. Ortolano.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A038 318, Price codes: A04 in paper copy, A01 in microfiche. Prepared for Army Engineer Institute for Water Resources, Fort Belvoir, VA, IWR Contract Report 76-2, December 1976. 67 p, 5 fig, 2 tab. DACW 73-73-C-0046.

**Descriptors:** \*Evaluation, \*Planning, \*Methodology, \*Water resources planning, Alternative planning, Flooding, Decision-making, Testing procedures, \*Iterative open planning process, \*Iterative planning, \*Public involvement, Field test, Public participation, Implementation, San Pedro Creek River Basin(CA).

The study consists of an experiment undertaken in the context of an ongoing water resources planning study of the Corps of Engineers San Francisco District. The report describes the field test and evaluation of an iterative, open planning process (IOPP) in which the four traditional planning activities are carried out concurrently, but with different degrees of emphasis over time. The four planning activities are problem identification, formulation of alternatives, impact assessment, and evaluation. The process is flexible and is opened to all affected interests by actively identifying them at many stages of planning. The IOPP was used to formulate and evaluate alternative solutions to flooding problems in the San Pedro Creek River Basin in California. In conjunction with the Corps, the researchers designed a study procedure and participated in plan formulation and evaluation activities. The report describes the various problems encountered during the implementation of the IOPP technique and discusses means to avoid these problems and make the technique more efficient and effective. The IOPP was still experimental when the research was initiated. A process similar to IOPP has recently been adopted by the Corps, lending new sig-

## Field 6—WATER RESOURCES PLANNING

### Group 6A—Techniques Of Planning

nificance to the study results and conclusions.  
(Nessa-NC)  
W78-12666

**THE ARIZONA WATER COMMISSION'S CENTRA ARIZONA PROJECT WATER ALLOCATION MODEL SYSTEM,**  
Arizona Water Commission, Phoenix.  
For primary bibliographic entry see Field 6E.  
W78-12924

### 6B. Evaluation Process

**ENHANCEMENT OF WATER RESOURCES INFORMATION TRANSFER AND RESEARCH IN VERMONT**  
Vermont Univ., Burlington. Water Resources Research Center.  
For primary bibliographic entry see Field 10D.  
W78-12116

**POLLUTION CONTROL IN A TWO-SECTOR DYNAMIC GENERAL EQUILIBRIUM MODEL,**  
Guelph Univ. (Ontario). Dept. of Economics.  
For primary bibliographic entry see Field 5G.  
W78-12197

**POLLUTION CONTROL IN A SIMPLIFIED GENERAL-EQUILIBRIUM MODEL WITH PRODUCTION EXTERNALITIES,**  
Kansas Univ., Lawrence. Dept. of Economics.  
For primary bibliographic entry see Field 5G.  
W78-12198

**ESTIMATION OF WATER PRODUCTION FUNCTIONS FOR EVALUATION OF IRRIGATION METHODS: A CASE STUDY IN CHILE,**  
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 3F.  
W78-12220

**THE UPPER RIO GRANDE,**  
New Mexico State Univ., University Park. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6E.  
W78-12229

**INTERNATIONAL EXTERNAL DISECONOMIES: THE COLORADO RIVER SALINITY PROBLEM IN MEXICO,**  
Escuela Nacional de Agricultura, Chapingo (Mexico); and Colorado State Univ., Fort Collins. Dept. of Economics.  
For primary bibliographic entry see Field 6E.  
W78-12231

**OCS DEVELOPMENT IN COASTAL LOUISIANA: A SOCIO-ECONOMIC IMPACT ASSESSMENT,**  
New Orleans Univ., I.A. Urban Studies Inst.  
A. J. Mumphy, Jr., R. E. Thayer, and F. W. Wagner.  
New Orleans University Urban Studies Institute Report to Louisiana State Planning Office, August 1977. 283 p, 16 fig, 61 tab, 51 ref, 3 append. LSP0-SPO-77-21.

Descriptors: \*Louisiana, \*Resources development, \*Economics, Sociology, Oil industry, Coasts, \*Outer Continental Shelf, Oil resources, Gas resources, Environmental impact.

In the seven chapters which comprise this study, various impacts of outer continental shelf (OCS) oil and gas development on the Louisiana coastal zone and related topics are discussed. Chapter 2 deals with the OCS related production, employment, and population impacts. The public service

sectors analyzed in Chapter 3 are education, highways, police protection, fire protection, water supply, solid waste disposal, sewerage, health and hospitals, and parks and recreation. Chapter 4 analyzes local needs, expenditures, and fiscal capabilities. Chapter 5, presents the stages of development, and the basic problems associated with development in this environment. The task of Chapter 6 is to assess the effectiveness of the planning and management capability of the local governments in Louisiana's coastal zone and recommend potential improvements. Chapter 7 provides a discussion of citizen participation at both the theoretical level and the practical level through an examination of the Louisiana Coastal Resources Program's Public Participation Program. (NOAA)  
W78-12307

**THE ROLE OF WATER DEVELOPMENT ADVISORY COUNCILS IN WATER RESOURCE PLANNING,**  
For primary bibliographic entry see Field 6E.  
W78-12478

**SOME CRITERIA FOR SELECTION BETWEEN CORRECTION OF THE INDICATIVE FLOW AND THE WASTE TREATMENT EFFICIENCY IN A SMALL RIVER BASIN,**  
Institute of Meteorology and Water Management, Warsaw (Poland).  
For primary bibliographic entry see Field 5D.  
W78-12535

**RETHINKING THE TIMETABLE FOR REFRESHING OUR WATERS,**  
For primary bibliographic entry see Field 5G.  
W78-12565

**PUBLIC INVOLVEMENT IN NATURAL RESOURCE DEVELOPMENT: A REVIEW OF WATER RESOURCE PLANNING,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Environmental and Urban Systems.  
For primary bibliographic entry see Field 6E.  
W78-12568

**A HISTORICAL SURVEY OF WATER UTILIZATION IN THE COOK INLET-SUSITNA BASIN, ALASKA,**  
Alaska Univ., College. Inst. of Water Resources.  
W. R. Hunt.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 964. Price codes: A02 in paper copy, A01 in microfiche. Report No. IWR-85, June 1978. 4 p. OWRT A-056-ALAS(1), 14-34-0001-6002.

Descriptors: \*Water utilization, \*Alaska, \*History, \*Cook-Susitna Basin(Alas).

An investigation of appropriate archival and published literature bearing on the history of the Cook Inlet-Susitna Basin indicated the importance of water utilization in the region. To a great extent the development of the region's diverse and changing economy in historic times was related to the availability and exploitation of certain water bodies. Some dissemination of the historic research has been presented in popular publications and other writings will bring public attention to the importance of water utilization.  
W78-12605

**POLICIES, ISSUES AND CONCERNS OF WATER AND RELATED LAND RESOURCES INTEREST GROUPS,**  
Kansas Water Resources Board, Topeka.  
For primary bibliographic entry see Field 6E.  
W78-12619

**SOCIAL IMPACT ASSESSMENT, 10.**  
Ad Hoc Interagency Working Group on Social Impact Assessment, October 1976, 20 p.

Descriptors: \*Local governments, \*Relocation, \*Social impacts, \*Methodology, \*Land development, \*Environment, \*Assessments, Social adjustment, Equity, Planning, Land use, \*Wisconsin Environmental Protection Act(WEPA), \*Citizen perception, \*Neighborhoods, \*Social environment, National Environmental Policy Act(NEPA), Displacement, Human needs, Environmental Impact Statements.

This issue is a collection of short methodological articles on how to assess social impacts of proposed land development projects. The general scope of the report explores how the physical environment of a neighborhood may be changed by proposed land development, and how these changes may affect neighborhood as a social environment. Areas investigated are recreational patterns at public facilities, recreational use of informal outdoor spaces, shopping opportunities, personal safety and privacy, aesthetics and cultural values. These articles are intended for use by planners, appropriate line agency staff, and interested citizens involved with land use decisions. The major problem in assessing social impacts is the lack of empirical data useful for analysis. The report recommends using citizen surveys, direct observation and diaries to collect the needed baseline data. The baseline data can also be used for planning purposes, since they can identify the needs of neighborhood residents and define the development criteria which residents believe would be most responsive to their needs. (Coast-NC)  
W78-12652

**THE FUTURE OF UNIVERSITY EDUCATIONAL PROGRAMS IN A 'STEADY-STATE' ENVIRONMENT,**  
For primary bibliographic entry see Field 6E.  
W78-12653

**DRAFT GUIDELINES FOR AREA-WIDE WASTE MANAGEMENT PLANNING. SECTION 200, FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972.**  
Environmental Protection Agency, Washington, DC.  
For primary bibliographic entry see Field 5G.  
W78-12658

**A ROLE FOR UCOWR IN MEETING NATIONAL NEEDS,**  
Idaho Univ., Moscow. Idaho Water Resources Research Inst.  
For primary bibliographic entry see Field 6E.  
W78-12659

**BOATER DECISION MAKING,**  
Wyle Lab., Huntsville, AL.  
M. Pfauth, C. Stiehl, and G. Lancaster.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A040 970. Price codes: A04 in paper copy, A01 in microfiche. Prepared for Department of Transportation, Coast Guard, Office of Research and Development, Washington, D.C., November 1976. 56 p, append. DOT-CG-40672-A, T.O. 21.

Descriptors: \*Boating, \*Accidents, \*Decision making, \*Risks, Behavior, Design, Recreation, Capsizing, Sink, Swamping, Small boats, Risk-taking, Accident analysis, Boat design, Coast Guard.

This study is designed (1) to determine whether a common cause exists for the capsizing, sinking and swamping of small boats; (2) to determine what design changes in boats would have prevented these accidents; and (3) to determine whether any behavioral problems, such as in-



creased risk-taking, would result from making these design changes. Phase I of this report tabulates and presents analyses of the most frequent causes of these boating accidents, an assessment of whether design changes would have prevented these accidents, suggested design changes, and an estimate of the effect of each design change. Phases II and III assess the effect of the recommended boat design changes on boaters, especially with respect to whether boaters' risk-taking level would increase and thus negate the accident prevention capacity of the design changes. Phase II presents the results from interviews and observations designed to uncover associations between boat design, environmental exposure, and personal characteristics. It also gives an indication of the effect of gross design differences on boaters' risk-taking behavior. While Phase II assesses the effects of gross design changes, it attempts to determine experimentally the effect of specific design changes on boaters' risk-taking behavior. (Nessa-NC) W78-12663

**PLAN OF ACTION: THE TRINITY RIVER PUBLIC INVOLVEMENT PROGRAM,**  
Texas A and M Univ., College Station. Dept. of Urban and Regional Planning.  
D. L. Pugh, and C. B. Corrich.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 798. Price codes: A04 in paper copy, A01 in microfiche. Army Corps of Engineer District, Fort Worth, September 1976, 46 p, 9 fig, 1 append. DACW63-76-C-0123.

Descriptors: \*Social participation, \*Planning, \*River basins, Methodology, Alternate planning, Flood control, Water quality, Recreation, Water supply, Navigation, \*Texas, River basin development, \*Public involvement, \*Trinity River(TX), \*River basin planning, Citizens Assistance Groups.

The Plan of Action is a comprehensive planning document setting forth the approach and procedures for achieving an active and viable program of public involvement in the planning process for the development of the Corps of Engineers Trinity River Project in Texas. The planning area includes the entire river basin, consisting of 22 counties divided into 3 regions, each constituting the planning area for a Citizens Assistance Group (CAG). The Plan will address flood control, navigation, water supply, recreation, fish and wildlife, environmental enhancement, and other topics. The Plan delineates the several alternatives available for: delineation of the planning area; delineation and composition of CAGs; and administration and operation of the CAGs. The process for selection of the appropriate alternative for each activity listed is explained and the selections are fully described along with the supporting rationale. The evaluation methods to be used are discussed, as is the system for providing a public opinion position statement for each major issue. The Plan was created within the context of the general goal of creating Citizen Assistance Groups composed of members whose attitudes fairly represent the interests of a majority of the citizens who live within the designated planning area. (Nessa-NC) W78-12664

**TESTING AN ITERATIVE, OPEN PROCESS FOR WATER RESOURCES PLANNING,**  
Stanford Univ., CA. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6A.  
W78-12666

**COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, VOLUME 1: SUMMARY REPORT.**

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 742. Price codes: A13 in paper copy, A01 in microfiche. Prepared for Red River Basin Coordinating Committee, June 1968, 176 p, 19 tab, 23 fig, 2 plates, 2 annexes. One of 8 volumes.

Descriptors: \*Planning, \*Water resources development, \*Land development, \*Regional analysis, \*River basin development, \*River basins, Arkansas, Louisiana, Texas, Oklahoma Institutions, Economics, Cost analysis, Recreation, Fish management, Wildlife management, Flood control, Bank stabilization, Drainage, Water supply, Navigation, Hydroelectric power, Environmental effects, Reservoirs, Multiple-purpose projects, Non-structural alternatives, \*Red River Basin, Single-purpose projects, Structural alternatives.

This volume is the Summary Report for the comprehensive basin study of the Red River below Denison Dam. The ad hoc Red River Coordinating Committee was composed of representatives of the U.S. Departments of Agriculture, Army, Commerce, Health, Education and Welfare, and Interior; the Federal Power Commission; and the states of Arkansas, Louisiana, Texas and Oklahoma. The study's purposes are to investigate those economic and physical development potentialities which interrelate with water and related land resources; to inventory associated short- and long-term needs concerning this development; and to recommend actions so that these potentialities might be realized. Specific problems addressed included flood control and drainage, water supply, navigation, hydroelectric power, recreation, fish and wildlife, bank stabilization, regional development, environmental aspects, and costs and monetary benefits. Early-action recommendations are reviewed as follows: (1) development of 49 upstream watershed multiple-purpose projects and 13 single-purpose upstream watershed reservoirs; (2) development of 12 major tributary reservoirs; (3) three channel improvement projects for local flood control; (4) modification of a local interest levee to conform to Federal standards; and (5) main stem navigation improvements and bank stabilization measures. Non-structural measures and programs proposed include better flood plain use; a public information effort; preservation of features of cultural, historical, archeological, scientific, ecological and aesthetic importance; and continued planning efforts. Final recommendations include periodic updating of the comprehensive plan and use of the report as a supporting document for project authorization requests submitted by construction agencies. (See W78-12761 thru W78-12767) (Zayac-NC) W78-12760

**COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, VOL. 2, APP. I: ECONOMICS; APP. II: CLIMATE AND METEOROLOGY; APP. III: HYDROLOGY, SURFACE GROUND WATER AND GEOLOGY; APP. IV: FLOOD CONTROL AND MAJOR DRAINAGE.**

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 743. Price codes: A12 in paper copy, A01 in microfiche. Prepared for Red River Basin Coordinating Committee, by Army Corps of Engineers and Department of Commerce, June 1968, 262 p. One of 8 volumes.

Descriptors: \*Water resources, \*Economics, \*Planning, \*Climates, \*Meteorology, \*Hydrology, \*Surface waters, \*Groundwater, \*Geology, \*Drainage, \*Flood control, Arkansas, Texas, Louisiana, Oklahoma, Cost analysis, Water supply, Economic prediction, Climatic data, Temperature, Winds, Evaporation, Runoff, Flood damage, Water resources development, Standard

Project Flood, Flow characteristics, Flooding, Stage-discharge relations, Peak discharge, Stormwater, Storm runoff, \*Red River Basin, Precipitation.

Volume 2 of the Red River Basin Study is comprised of four appendices. Appendix I presents the economic trends of the area encompassed within the Red River Basin below Denison Dam. It endeavors to establish a comprehensive concept of the economic growth of the study area and then attempts to relate this growth to that of the four states—Oklahoma, Texas, Louisiana and Arkansas—involved, and also to the nation as a whole. Included in the study are a discussion of the present economy, a determination of economic indicators, and economic projections. Appendix II presents a brief discussion of the study area's climatological data, including temperature, precipitation, wind and evaporation. Climatological and meteorological data published by the Environmental Science Services Administration are presented. Appendix III presents information on the geologic features and hydrologic environment of the study area to be used for both evaluating the sources. Included in the appendix are reviews of the basin's geology, runoff characteristics, and water supplies, the hydrology of the Red River, and a discussion of the standard project flood. Appendix IV presents results of an analysis of flood control and major drainage problems along the Red River and its major tributaries below Denison Dam. Data are presented on flood control and major drainage needs for areas susceptible to fluvial flooding. Also discussed is the potential increase in flood damage due to future development. Projects to satisfy short-term (10-15 years) needs are presented, and solutions to long-term (100 years) problems are suggested. (See also W78-12760) (Zayac-NC) W78-12761

**COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, TEXAS, VOLUME 3, APPENDIX V: UPSTREAM WATERSHED PROTECTION, USE, MANAGEMENT, AND DEVELOPMENT.**

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 750. Price codes: A12 in paper copy, A01 in microfiche. Prepared by Red River Basin Coordinating Committee, by U.S. Department of Agriculture, June 1968, 238 p, 83 tab, 14 fig, 43 exhibits. One of 8 volumes.

Descriptors: \*Water resources development, \*Land development, \*Agricultural watersheds, \*Forest watersheds, Arkansas, Texas, Oklahoma, Louisiana, Multiple purpose projects, Multiple purpose reservoirs, Population, Economics, Surface water availability, Surface water, Drainage, Flood control, Erosion, Soils, Recreation, Irrigation, Non-structural alternatives, Water supply, \*Upstream watersheds, \*Red River Basin, \*Agricultural resources, Single purpose projects, Single purpose reservoirs, Conservation Needs Inventory.

Objectives of this study are to identify water and related land resource problems; to prepare a potential plan for development of those resources; to compile agricultural and forestry data needed for the plan; and to prepare engineering, economic and related data that local organizations might use in developing the resources. Population and economic projections indicate that water deficits in agricultural production are expected by 1980 and will increase until 2010. Additional development is needed for flood prevention, water supply, pollution abatement and recreation. The dendritic drainage pattern of the study area consists of 193 Conservation Needs Inventory (CNI) watersheds within 24 tributary basins. Of these watersheds, 122 are unfeasible for any development. Nearly all of the productive agricultural and forestry base area is adversely affected by soil erosion, soil

## Field 6—WATER RESOURCES PLANNING

### Group 6B—Evaluation Process

limitation and excess water problems. Conservation treatment by land user conversion and common soil and water conservation practices are suggested. Recommendations are made for single and multiple purpose reservoirs to meet irrigation and recreation needs in the area. The most obvious impacts of potential project development are conversions of land to water needs. However, increased agricultural production needs can be met by allowing formerly flooded and poorly drained land to be farmed more productively. Irrigation can increase production. Potential projects should result in better overall agricultural economic impacts such as rural employment and income; however, reduction of woodland acreage would adversely affect forest industry and related employment. (See also W78-12760) (Zayac-NC) W78-12762

#### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, TEXAS. VOL. 4, APPENDIX VI: IRRIGATION; APPENDIX VII: DRAINAGE AND FLOOD PREVENTION ON FLATLANDS.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 751, Price codes: A12 in paper copy, A01 in microfiche. Prepared for Red River Basin Coordinating Committee, by Department of the Interior, June 1968, 260 p., one of 8 volumes.

Descriptors: \*Irrigation, \*Water resources development, \*Economics, \*Drainage, \*Land management, \*Agriculture, \*Agricultural watersheds, \*Flood plains, Texas, Arkansas, Oklahoma, Louisiana, Irrigable land, Water requirements, Irrigation engineering, Arable land, Irrigation water, Water rights, Irrigation design, Irrigation canals, Irrigation effects, Irrigation practices, Flood control, Flood damage, Flood irrigation, Flood protection, Forest management, Crops, Land resources, \*Red River Basin, \*Flatlands.

The objectives of the irrigation investigations presented in Appendix VI include determination of the extent of the drought problem in the river basin and possible solutions. Included in the investigation were the creation of inventories of land suitable for irrigation, land currently irrigated by crops, irrigation facilities, project type lands, and water resources; the appraisal of feasibility for irrigation development; the study of potential irrigation development; and a review of irrigation water requirements for potential development. Present irrigation problems are investigated by summarizing irrigation development, water laws by states, water quality and water requirements. Potential irrigation development is studied through water availability, economic factors, future needs and potential development. The purpose of Appendix VII is to identify and inventory both drainage and flood prevention on flatlands as they pertain to water management. This analysis was conducted to facilitate consideration of comprehensive plans; it attempts to evaluate the total average annual reduction in net incomes due to the drainage and flood problems which occur with present cropping patterns and farming conditions. The problem of drainage and flood prevention development feasibility is studied through factors—physical, economics and crop yields and technology—affecting feasibility and also drainage and flood prevention in forestry management. An appraisal of the potential for drainage and flood prevention development is conducted by investigating the feasibility of outlet channels, economic factors, and potential drainage and flood prevention development. (See also W78-12760) (Zayac-NC) W78-12763

#### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, TEXAS. VOL. 5, APP. VIII: MINERAL RESOURCES AND MINERAL

#### INDUSTRY: APP. IX: ARCHEOLOGICAL, HISTORICAL AND NATURAL RESOURCES: APP. X: HYDROELECTRIC POWER.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 752, Price codes: A10 in paper copy, A01 in microfiche. Prepared for Red River Basin Coordinating Committee, by Department of the Interior and Arkansas University Museum, June 1968m, 219 p., one of 8 volumes.

Descriptors: \*Archeology, \*Natural resources, \*Mineral industry, \*Water resources development, \*Hydroelectric power, Texas, Arkansas, Oklahoma, Louisiana, Mining, Planning, Hydroelectric plants, Electric power production, Energy, Economics, Electric power plants, Development, \*Historical resources, \*Mineral resources, \*Red River Basin, Pumped-storage installations, Reversible-unit installations, Power needs.

The objectives of Appendix VIII are to report on the nature and extent of mineral occurrences and of the mineral industry in the Red River Basin, and to determine the nature and scope of involvement of these resources and industry in basin development plans. Physical aspects of the basin are first presented, followed by an inventory of mineral resources and industry (especially petroleum and natural gas, cement, sand and gravel, iron ores, stone, clay, lignite, salt and gypsum). Geographic distributions are summarized. Appendix IX has three objectives: to review the history of the basin; to comment on the potentialities of the basin's archeological, historical and natural resources; and to evaluate the dangers to those resources inherent in a water resources development plan such as is being considered for the Red River Basin. The natural setting and environment are reviewed, as well as the history of archeological work and the basin's history and prehistory. Assessments and recommendations by state are then made concerning these resources. Appendix X inventories existing and projected power supply requirements. Conventional plants, reversible unit installations, and pumped storage installations were considered. This information is then used to determine if the potential hydroelectric development in the Red River Basin below Denison Dam is feasible and would be usable in serving the estimated future power loads in the power market area while adhering to the long-range basin plans for the development of water and related land resources. Potential hydroelectric projects were screened and selection of projects for immediate consideration was made within the limitations imposed by other basin development. (See also W78-12760) (Zayac-NC) W78-12764

#### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, APP. XI: WATER SUPPLY & WATER QUALITY CONTROL: APP. XII: OUTDOOR RECREATION: APP. XIII: FISH & WILDLIFE.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 753, Price codes: A09 in paper copy, A01 in microfiche. Prepared for by Red River Basin Coordinating Committee, Department of the Interior and Federal Water Pollution Control Administration, June 1968, 195 p. One of 8 volumes.

Descriptors: \*Fish management, \*Wildlife management, \*Recreation, \*Water quality, \*Water supply, \*Planning, \*Water resources development, Texas, Oklahoma, Arkansas, Louisiana, Water resources, Fisheries, Water quality control, Water quality standards, Cost-benefit analysis, Water supply development, River basin development, River basins, \*Red River Basin.

The purposes of Appendix XI are to study present water use and potential water supply development; to project water requirements for municipal

and industrial use; to determine existing and potential pollution problems; to review the effects of the comprehensive plan on the water quality of the basin's streams; to evaluate alternatives; and to study water supply allocation. Present municipal and industrial water use is studied and future water requirements are projected. Water quality control is discussed and a water quality control plan is suggested, followed by a determination of benefits. The goal of Appendix XII is to develop a plan to meet the outdoor recreation needs of the market and to provide an equitable distribution of opportunity. Outdoor recreation areas are reviewed by three categories of recreation activities. Emphasis was placed on determining the demand, supply and needs of the outdoor recreating public in the basin; appraising recreation potentials; evaluating the extent of short- and long-range development programs; and recommending specific action to meet the demand for outdoor recreation in the next 10-15 years. Appendix XIII is a study of expected fish and wildlife populations and associated human demands for these natural resources within the study area. The primary objective was to formulate realistic fish and wildlife planning that would provide for the development and utilization of these resources. (See also W78-12760) (Zayac-NC) W78-12765

#### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS. VOLUME 8, APPENDIX XV: PLAN FORMULATION.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 755, Price codes: A09 in paper copy, A01 in microfiche. Prepared for by Red River Basin Coordinating Committee, by Plan Formulation Task Force, June 1968, 184 p., 33 tab, 21 fig, 2 plates. One of 8 volumes.

Descriptors: \*Regional analysis, \*Planning, \*Long-term planning, \*Short-term planning, Texas, Oklahoma, Arkansas, Louisiana, Environmental effects, Navigation, Irrigation, Water supply, Water quality, Drainage, Flood control, Recreation, Fish management, Wildlife management, Non-structural alternatives, Watersheds, River basin development, River basins, Bank stabilization, \*Red River Basin.

This volume presents the comprehensive plan of development for the Red River Basin and describes and analyzes the planning processes leading to its development. Designed to meet water and land resource needs for the next 100 years, the plan reviews water supply for municipal, industrial and irrigation uses; water quality control; flood control; drainage; watershed protection; navigation; bank stabilization; hydroelectric power; grazing and cropland improvements; forestry production; outdoor recreation; fish and wildlife enhancement; regional development; environmental protection; and control of disease bearing vectors. Suggestions for Congressional authorization in the next 10-15 years are presented as a framework for future development. The Appendix is meant to serve as a summary and analytical tool for data generated throughout the study. Problems and needs are inventoried first. Then planning goals and objectives are discussed, followed by solutions considered for each of the previously discussed problems and needs. A comprehensive plan of development is outlined. An early-action plan is presented which specifically consider major reservoir improvements, local flood protection, upstream watersheds, navigation and bank stabilization, improvements for fish and wildlife, recreation needs and nonstructural measures. Lastly, a long-range plan of development is suggested. (See also W78-12760) (Zayac-NC) W78-12766

#### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOU-

**SIANA, OKLAHOMA, AND TEXAS. VOLUME 7, APPENDIX XIV: STATE WATER LAWS, POLICIES AND PROGRAMS.**

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 754, Price codes: A14 in paper copy, A01 in microfiche. Prepared for Red River Basin Coordinating Committee, June 1968, 307 p, 4 sections. One of 8 volumes.

Descriptors: \*Planning, \*Water resources development, \*Water law, \*Water policy, \*Programs, \*Legislation, \*Land resources, Texas, Arkansas, Louisiana, Oklahoma, Institutions, Legal aspects, Water permits, Water rights, Public rights, Judicial decisions, River basins, \*Red River Basin.

The purpose of this Appendix is to identify and catalogue those state laws, policies and programs relating to water use and control in order to define the nature and extent of participation by the states in the development of the water and land resources of the basin. The Appendix is divided into four sections, each section reviewing state water laws, policies and programs in each of the four states of Arkansas, Louisiana, Oklahoma and Texas. Principles and concepts of state laws as defined by the state constitutions, statutes, case law and opinions are presented. Water rights are discussed concerning surface and ground waters, access to surface waters, diversion and eminent domain. Regulatory authorities are reviewed. Lastly, instrumentalities concerned with water and related land resources are inventoried, including state agencies, universities, political subdivisions and regional authorities. (See also W78-12760) (Zayac-NC) W78-12767

**BIG BLACK RIVER, MISSISSIPPI—COMPREHENSIVE BASIN STUDY, VOLUME I: INTERAGENCY SUMMARY REPORT.**

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 816, Price codes: A06 in paper copy, A01 in microfiche. Prepared for Big Black River Basin Coordinating Committee, April 1968, 58 p, 5 tab, 14 fig, 3 plates, 1 attachment. One of 5 volumes.

Descriptors: \*Water policy, \*Planning, \*Water resources, \*Non-structural alternatives, \*Recreation facilities, \*Reservoirs, Mississippi, Water quality, Water supply developments, Watersheds(Basins), Land resources, Stabilization, Flood control, Flooding, Agricultural watersheds, Recreation demand, Multiple-purpose reservoirs, Channel improvement, Fisheries, Wildlife management, Water quality control, Water supply, Land treatment, Cost-benefit ratio, \*Management, Structural alternatives, Upstream development, \*Big Black River Basin(MS).

This study presents a proposed plan for the development and management of water and related land resources of the Big Black River Basin. This plan is aimed at providing 'the best use or combination of uses of these resources to satisfy the immediate and long-range needs within the Basin'. The planning period is 50 years. The conclusions are that there are important needs for flood protection, agricultural facilities, fish and wildlife conservation, and for agricultural land and water management. Proposals include both near-term (10-15 years) and long-term programs. Near-term recommendations include upstream watershed development, expansion of two existing recreational areas, and non-structural measures. Upstream watershed development is recommended for 32 of the area's 37 subbasins; land treatment and critical area stabilization is recommended for all subbasins. Included are such structural measures as floodwater retarding structures, multiple-purpose structures and channel improvement. Two recreational areas are scheduled for upgrading. Non-structural measures include wildlife, fisheries and land management programs, enforce-

ment of proposed water quality control programs, surveillance of potable water supplies, and informational and coordinating flood control programs. Long-range recommendations are scheduled upon future anticipated needs of the study area. Features include a main stem reservoir, tributary reservoirs at selected sites, 5 tributary upstream watershed programs, a navigable waterway project linking Jackson with the Mississippi River, and expansion of existing recreational areas. These recommendations should be considered as the economic development of the Basin warrants. (See W78-12769 thru W78-12772) (Zayac-NC) W78-12768

**BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY. VOLUME II, ANNEX A: AGRICULTURAL REQUIREMENTS AND UPSTREAM WATERSHED DEVELOPMENT.**

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 817, Price codes: A08 in paper copy, A01 in microfiche. Prepared for Big Black River Basin Coordinating Committee, by Department of Agriculture, Soil Conservation Service, Economic Research Service, Forest Service. Jackson, MS, June 1968, 167 p, 62 tab, 9 fig.

Descriptors: \*Agriculture, Water resources, \*Land resources, \*Planning, Mississippi, Crop production, Agricultural watersheds, Agricultural runoff, Agricultural engineering, Land management, Soil conservation, Irrigation programs, Cultivated lands, Farms, Farm units, Forestry, Rural areas, Small watersheds, Crops, Fish management, Wildlife management, Non-structural alternatives, Cost analysis, Economics, Institutions, \*Management, \*Big Black River(MS), Structural alternatives.

Annex A summarizes studies made by the Department of Agriculture. These studies were undertaken in connection with the comprehensive planning done for the Big Black River Basin as reviewed in the Interagency Summary Report. Annex A is oriented primarily to upstream watershed development. First the physical and environmental characteristics of the basin are inventoried—location and size, geology, soils, climate, land use and cover, hydrology, fish and wildlife and timber resources. Secondly, economic development, present and projected, is described in terms of population, labor force, employment, personal income and households. The agricultural economy is next reviewed—farm production, commodity requirements, production versus requirement, farm income, farmland and forestry resources. The study then moves into investigating the interrelationships of critical planning parameters. Water and related land resource problems and needs are investigated by discussing erosion, floodwater, sediment, drainage and then applying these data to management needs in flood control and prevention, land conservation, livestock, recreation and fish and wildlife. The potential for water and land resource development is studied through land and surface availability, groundwater potentials, recreation and fish and wildlife. Existing programs are then presented, followed by USDA's plan formulation. Finally, water and related land resource programs and measures recommended for early action are suggested. Included here are basin-wide projects, structural and non-structural projects, cost comparisons and recommended institutional arrangements. (See also W78-12768) (Zayac-NC) W78-12769

**BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY. VOLUME III, ANNEX B: ENGINEERING STUDIES OF WATER DEVELOPMENT PROJECTS.**

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 818, Price codes: A11 in paper copy, A01 in

microfiche. Prepared for Big Black River Basin Coordinating Committee, by Department of the Army, Vicksburg District, Corps of Engineers, Vicksburg, MS, April 1968, 246 p, 13 tab, 2 fig, 8 plates, appendices.

Descriptors: \*Engineering structures, \*Engineering, \*Water resources development, \*Reservoirs, \*Multiple purpose projects, Mississippi, Non-structural alternatives, Recreation facilities, Flood control, Flood damage, Flood plains, Fish management, Wildlife management, Reservoir sites, Economics, Cost analysis, Farms, Multiple purpose reservoirs, Planning, \*Big Black River(MS), \*Management, Structural alternatives.

Annex B summarizes engineering studies of water resource projects in Mississippi's Big Black River Basin. These studies were undertaken in conjunction with the comprehensive planning done for the Basin as reviewed in the Interagency Summary Report. Two main conclusions are reached in this annex. First, the main stem of Big Black River has a serious flooding problem; and second, there is a pronounced need for water-oriented recreation and fish and wildlife conservation. Recreation reservoirs are the most economically feasible alternatives. However, two factors militate against their realization: major reservoirs would inundate productive farmland and are opposed by local interests; and the construction by Federal agencies of single-purpose reservoirs is prohibited by law. There is economic justification for plans considered to provide flood protection on the main stem by channel improvement, levees, main stem or tributary reservoirs or any combination of these. Specific recommendations follow: multipurpose reservoirs must be further considered; long-range development planning must be incorporated; main stem channel improvement for flood control should be restudied in the future depending on the area's economic development; an integrated and comprehensive system of flood plain planning and flood protection be adopted by the concerned entities in the study area; and that no additional work for flood control and related purposes be undertaken by the Corps of Engineers at present. (See also W78-12768) (Zayac-NC) W78-12770

**BIG BLACK RIVER, MS: COMPREHENSIVE BASIN STUDY: VOL. IV, AN. C—RECREATION ASPECTS: AN. D—FISH & WILDLIFE RESOURCES: AN. E—MUNICIPAL & INDUSTRIAL WATER SUPPLY & WATER QUALITY CONTROL: AN. F—GEOLOGY & WATER RESOURCES: AN. G—ARCHAEOLOGICAL, HISTORIC, & NATURAL RESOURCES.**

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 819, Price codes: A13 in paper copy, A01 in microfiche. Annexes prepared for Big Black River Basin Coordinating Committee, by Dept. of the Interior, Southeast Region, Atlanta, GA.

Descriptors: \*Recreation, \*Fish management, \*Wildlife management, \*Water supply, \*Water quality, \*Water resources, \*Geology, \*Archeology, \*Natural resources, \*River basin development, Mississippi, Planning, Surface water availability, Groundwater resources, Water demand, \*Big Black River(MS), Historic sites.

Each annex reviews an important aspect of the comprehensive planning undertaken for the Big Black River Basin as presented in the Interagency Summary Report. The purpose of Annex C is to determine the impact of water resource development projects on outdoor recreation and to present a general plan for the outdoor recreation development of identified water and related land resources to meet outdoor recreation needs. An inventory of existing public outdoor recreation areas is included. Annex D provides information on current and projected sport fishing, hunting and commercial fisheries demands, supply of resources, and a proposed fish and wildlife plan. Long range



## Field 6—WATER RESOURCES PLANNING

### Group 6B—Evaluation Process

planning is an integral part of the study. The objectives of Annex E are to appraise basin water quantities and qualities; to summarize present and future municipal and industrial water supply demands; to investigate regulatory needs; to assess minimum water quality standards; and to study storage for both supply and stream flow control. The FWPCA finds that storage of water for water quality control will be required in a proposed industrial expansion plan materializes; and that future water requirements can be met from ground water sources. Annex F is a summary description of the geohydrology and water resources of the Basin and of ground water-surface water relationships. Its purpose is to inventory the facts needed to develop optimally the natural and cultural resources of the Basin. Findings indicate that abundant water supplies of good quality are available. Annex G summarizes the Basin's natural setting, especially in relation to demographic patterns. Settlement histories are explored and archeological findings are evaluated. No conflicts are seen between proposed development and historic sites, nor between proposed channelizations and archeological sites. (See also W78-12768) (Zayac-NC) W78-12771

**BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY. VOL. V, AN. H: HYDROELECTRIC POWER: AN. I: ROLE OF THE STATE OF MISSISSIPPI IN THE PLANNING & DEVELOPMENT OF THE WATER AND RELATED LAND RESOURCES: AN. J: TRANSCRIPTS OF PUBLIC HEARINGS.** Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 820. Price codes: A12 in paper copy, A01 in microfiche. Prepared for Big Black River Basin Coordinating Committee, Annex H prepared by Federal Power Commission, Fort Worth, TX. Annex I prepared Mississippi Board of Water Commissioners, Jackson, April 1968.

Descriptors: \*Multiple-purpose projects, \*Hydroelectric power, Water resources, \*Water law, \*Legal review, Mississippi, Hydroelectric plants, Planning, Water resources development, Legal aspects, Cost-benefit analysis, Economics, Peak power, Peaking capacity, Reservoirs, Public hearings, \*Big Black River Basin(MS), Transcripts.

Annex H has as its objective the determination of whether or not potential multiple-purpose—especially hydroelectric—development in the Big Black River Basin is feasible and would be applicable to the estimated future power loads in the market area. This must be accomplished while also adhering to the long-range Basin development plans. The annex first inventories power resources and needs in the market area. Screening of potential hydroelectric projects is then undertaken. The study finds that development of a multiple-purpose project, including hydroelectric power, at the Basin's Edwards site is presently uneconomical. However, cost-benefit analysis indicates that 5-10 percent better economies—in terms of scale and peaking requirements—could justify the proposed plant. The study indicates that if at some future time a development for other purposes at this site is found to be desirable, hydroelectric power should receive careful consideration as a project purpose. Annex I presents pertinent sections of Mississippi law relating to the development and use of state water resources. These sections are scattered throughout the State Constitution and the Mississippi Code; this annex seeks to gather these sections together with a special effort made to recognize their applicability to the Big Black River Basin. Included are the relevant references to water rights, regulatory authority over water and rights to water, and establishment of State agencies whose activities have impact upon the development and use of the state's water resources. Annex J presents transcripts of public hearings concerned with the Basin's water

resource planning. (See also W78-12768) (Zayac-NC) W78-12772

**DISAGGREGATED INTERTEMPORAL MODELS WITH AN EXHAUSTIBLE RESOURCE AND TECHNICAL ADVANCE.** Northwestern Univ., Evanston, IL. Graduate School of Management. M. I. Kamien, and N. L. Schwartz. Journal of Environmental Economics and Management, Vol. 4, No. 4, p 271-288, 1977. 15 ref.

Descriptors: \*Technology, \*Model studies, \*Exhaustible resources, \*Resource allocation, \*Centralized planning, \*Decentralized planning, Economics, Research and development, Natural resources, Externalities, Production functions, Capital.

Centralized and decentralized planning for allocation of an exhaustible resource are quantitatively compared under different market structures, abstracting from externalities and uncertainty as sources of difference. Three decentralized and one centralized economic model are compared, assuming a new endogenous technological advance may occur which would release or reduce dependence on the exhaustible resource. Overall qualitative temporal behavior of the optimal resource-capital ratio, per capita consumption, and investment in research and development are the same in all four models. Specifically, the optimal resource-capital ratio declines through time, while the time profiles of per-capita consumption and research and development expenditure are single-peaked. A decentralized competitive model can replicate the behavior of a centrally planned economy, given an appropriate distribution of initial wealth. This holds true whether research and development is done by the government or by the natural resource sector, so long as borrowing from other sectors is possible. The necessity for resource owners to self-finance development of the new technology tends to accelerate decline of the resource-capital ratio, indicating that the resource may be depleted faster than is optimal. The behavior of the economy is independent of the market structure in the resource sector if and only if the production function is Cobb-Douglas. (Lynch-Wisconsin) W78-12877

**THE VALUE AND DISTRIBUTION OF THE BENEFITS OF NORTH SEA OIL AND GAS, 1970-1985.**

National Inst. of Economic and Social Research, London (England). S. A. B. Page. National Institute Economic Review, No 82, p 41-58, November 1977. 4 tab, 7 ref.

Descriptors: \*Benefits, \*Value, \*North Sea, \*Oil industry, \*United Kingdom, \*Natural gas, Distribution, Income distribution, Economics, International trade, Prices, Oil fields, Depletion, Balance of payments, Energy, Public policy, Economic policy.

North Sea oil and gas will make the United Kingdom a net exporter of energy in the 1980s and supply a substantial portion of its need through the 1990s. Monetary benefits will accrue principally to balance of payments and government revenue. Balance of payments will significantly improve relative to the current status or that of other industrial countries, though the improvement will be slight compared to the situation prior to the rise in oil prices. The absolute amount of benefits and government share are extremely sensitive to exchange rate changes, including those which result from balance of payment improvements. Allocation of benefits has largely been determined by means of distribution decisions currently being made in the energy sector and for the exchange rate. OECD estimates show oil production in the

United Kingdom rising from 12 million tons in 1976 to 104 million in 1980 and 145 million in 1985. Consumption in the United Kingdom is projected to increase from 95 million tons in 1976 and 1980 to 115 million in 1985. In forecasting over the next eight years it is assumed that oil output will come almost entirely from fields already discovered, and mainly from fields already declared commercial. This detailed analysis discusses output, depletion policy and reserves, world and U.K. prices, benefits of North Sea production, effects on the economy, and economic policy. (Lynch-Wisconsin) W78-12881

**RESOURCE DEVELOPMENT ALTERNATIVES: AN EVALUATION STRATEGY.**

Simon Fraser Univ., Burnaby (British Columbia). Dept. of Economics. J. L. Knetsch, and W. M. Fleming. Annals of Regional Science, Vol 11, No 3, p 39-50, 1977. 2 fig, 1 tab, 11 ref.

Descriptors: \*Analytical techniques, \*Alternative planning, \*Preservation, \*Lumbering, \*Lake of the Hanging Glaciers(British Columbia, Canada), \*Resources development, Environmental effects, Recreation facilities, British Columbia(Canada), Canada, Natural resources, Lakes, Glaciers, Mountains, Opportunity costs, Methodology, Economics, Valuation, Value, Willingness to pay.

Lake of the Hanging Glaciers in the Purcell Mountains of southwestern British Columbia, Canada, is used to illustrate a strategy for facilitating planning choices for or against developmental disruption of a pristine site. The lake and surrounding area form an unusually beautiful and unique setting, but the watershed also contains substantial and accessible stands of old growth timber of commercially valuable species. Factors which influence expected worth of nonmeasurable values of amenities and wilderness recreation are considered, and the study demonstrates how information can be usefully organized to aid planning choices between the preservation and development options. A major objective was improvement of planning decisions in such cases, in particular using formal procedures to assess environmental impact. In the case evaluated, an estimated forestry loss of \$450,000 would result from preserving the watershed in its present condition, in addition to expenditures of \$260,000 to enhance recreation and preserve the amenity values, for a total of \$710,000 if preservation is selected. Use of willingness-to-pay analysis to value the preservation option showed that, while the preservation value is likely to be low in the first year (about \$3000), long-run benefits clearly indicate the superiority of this option. With few or no substitutes for the site, it is assumed that people collectively would be willing to sacrifice more than the timbering value to preserve the area. (Lynch-Wisconsin) W78-12883

**WATER RESOURCE PROBLEMS MERGE WITH ENERGY, LAND-USE POLICIES ON GLOBAL SCALE.**

National Society of Professional Engineers, Washington, DC. For primary bibliographic entry see Field 6E. W78-12928

**RESPONSE TO DROUGHT,**

Institute for Water Resources (Army), Fort Belvoir, Va. R. Hamson. Water Spectrum, Vol. 9, No. 3, p 34-41, Summer, 1977. 5 fig.

Descriptors: \*Droughts, \*Water conservation, \*Water management(Applied), Regional development, State governments, Irrigation systems, Water rights, Legal aspects.

The responsibility for water management in times of drought lies primarily on individuals as well as on state and regional authorities. Water conservation programs can reduce residential consumption by curtailing activities such as car washing. Conservation in agriculture could bring about substantial long term savings, but results would be delayed since water-saving techniques require sizeable investments in improving irrigation systems. Water supplies can be temporarily increased by drawing upon groundwater or in some cases by cloud-seeding. Reallocation efforts are hampered by the regime of water rights that predominates in the west. (Russell-Arizona)  
W78-12943

### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

**A STATISTICAL ANALYSIS OF FACTORS AFFECTING WATER PRICES IN SMALL MUNICIPALITIES.**  
Mississippi Univ., University. School of Business Administration.  
For primary bibliographic entry see Field 3D.  
W78-12118

**COST OF HOT WATER SUPPLY REDUCED BY SOLAR HEATING.**  
C. Taylor.  
Vector (Pinetown), No. 11, p 16-19, 1976. 3 fig.

Descriptors: \*Solar energy, \*Solar heating, Water temperature, \*Costs, Domestic water, South Africa.

With the almost continual rise in the cost of electricity, gas, oil and coal the stage has been reached where, with available technology and particular emphasis on marketing, solar heating is both a practical and economical proposition. The basic concept is to reduce the cost of hot water by using solar energy to preheat the water supplied to an existing hot water installation fueled by electricity, oil etc. With sufficient solar energy available, the heater has then only to raise the water temperature from 55 degrees centigrade or 60 degrees centigrade to the required figure instead of from the usual 15 degrees centigrade or 20 degrees centigrade. (So Afr Water Info Ctr)  
W78-12391

**WATER RESOURCES - THE SOUTHERN AFRICAN PICTURE.**  
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.  
For primary bibliographic entry see Field 4A.  
W78-12423

**DISCOUNTED FLOOD RISKS IN LEAST-COST DESIGN OF STORM SEWER NETWORKS.**  
Illinois Univ. at Urbana-Champaign. Dept. of Civil and Ceramic Engineering.  
For primary bibliographic entry see Field 5D.  
W78-12612

**DISAGGREGATED INTERTEMPORAL MODELS WITH AN EXHAUSTIBLE RESOURCE AND TECHNICAL ADVANCE.**  
Northwestern Univ., Evanston, IL. Graduate School of Management.  
For primary bibliographic entry see Field 6B.  
W78-12877

**A NOTE ON THE USE OF PROPERTY VALUES IN ESTIMATING MARGINAL WILLINGNESS TO PAY FOR ENVIRONMENTAL QUALITY.**  
Handelshogskolan i Stockholm (Sweden).  
For primary bibliographic entry see Field 5G.  
W78-12879

**THE EFFECTS OF POLLUTION TAXATION ON THE PATTERN OF RESOURCE ALLOCATION: THE DOWNSTREAM DIFFUSION CASE.**  
Tel Aviv Univ. (Israel).  
For primary bibliographic entry see Field 5G.  
W78-12880

**THE VALUE AND DISTRIBUTION OF THE BENEFITS OF NORTH SEA OIL AND GAS, 1970-1985.**  
National Inst. of Economic and Social Research, London (England).  
For primary bibliographic entry see Field 6B.  
W78-12881

**PAYING FOR WATER - BY RATES OR CHARGES.**  
Water Pollution Research Lab., Stevenage (England).  
T. Whiteley.  
National Westminster Bank Quarterly Review, August 1977, p 31-40. 6 ref.

Descriptors: \*Water policy, \*Water management (Applied), \*Water rates, \*United Kingdom, \*Water demand, \*Water costs, \*Metering, \*Taxes, Economics, Water supply, Water utilization, Cost-benefit analysis, Equity, Municipal water, Domestic water, Industrial water, Potable water.

Various methods of assessing water costs to customers in the United Kingdom are evaluated, and a combination of a standing charge for all users supplemented by volumetric metered rates for commercial and industrial customers is recommended. The fixed charge would reflect the expense of adding a user to the system, while metering high-use customers would permit control of demand when necessary. Case studies are cited to demonstrate that metering achieves very little water savings while possibly increasing overall costs. In addition, the difference in cost to the water authority between five gal/hr and 100 gal/hr is negligible. At a certain standard of living water use reaches a plateau, and therefore holding down household use through metering could depress the living standard of lower income classes. Alternatives to meters include: (1) property tax, (2) poll tax, (3) equipment and facility tax, or (4) income tax. All have the disadvantage that the size of the bill cannot be lowered by reducing use, and political and equity drawbacks exist as well. Present charges are too low to significantly affect demand, as aggregate municipal water use is relatively inelastic, about -0.4 to -0.5. (Lynch-Wisconsin)  
W78-12882

**THE GREENING OF THE DESERT: WHAT COST TO FARMERS.**  
For primary bibliographic entry see Field 3F.  
W78-12932

### 6D. Water Demand

**THE ECONOMIC DEVELOPMENT OF TIJUANA IN RELATION TO WATER SUPPLY AND ATMOSPHERIC, MARINE AND AQUATIC CONTAMINATION.**  
Sonora Univ., Hermosillo (Mexico). School of Law and Social Sciences.  
For primary bibliographic entry see Field 6E.  
W78-12227

**INTERACTIONS IN WATER RESOURCE DEVELOPMENT.**  
Department of Water Affairs, Pretoria (South Africa).  
J. P. Kriel.  
In: Conference on resources of Southern Africa today and tomorrow, (Johannesburg), South Africa, p 234-241, September 22-26, 1975, 1 tab.

Descriptors: \*Water resources development, \*Agricultural use, \*Industrial use, \*Domestic consumption, Regional water authorities, Energy generation, Hydroelectric power, Water quality, Wildlife conservation, \*Competing uses, \*South Africa.

The need is described for a balance between advances in effectiveness of developing natural resources on the one hand and administrative and management expertise on the other. He sees the opportunity to plan and implement the balanced development of water and the other natural resources necessary to support the 'coming of age' of the subcontinent. In the article he dwells upon the present and future demand for water in South Africa and mentions the part that water resource development will have to play in the food and agricultural field, mineral resources development, energy supply, forestry and nature conservation. He concludes with the thought that there is good reason to believe that the future development of natural resources in South Africa can be faced with optimism - provided a far-sighted and imaginative but soundly based approach is maintained as we prepare today for the problems of tomorrow. (So Afr Water Info Ctr)  
W78-12421

**RESOURCES DEPLOYED IN WATER RE-USE.**  
Pretoria Univ. (South Africa).  
For primary bibliographic entry see Field 3C.  
W78-12422

**WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT: WHAT ARE THE NATION'S WATER SUPPLY PROBLEMS AND ISSUES.**  
General Accounting Office, Washington, DC.  
Report CED-77-100, July 28, 1977, 52 p, append.

Descriptors: \*Water supply, \*Water demand, \*Planning, \*Water resources development, \*Evaluation, \*Water resources planning, Water reuse, Water conservation, Water law, Cost-benefit analysis, Water quality, Conjunctive use, Cost sharing, Priorities.

The study's purpose is to identify existing and emerging U.S. water supply problems. The issues and concerns identified as meriting attention include: whether existing water resource plans and programs are adequate to meet competing demands for water uses; whether water agencies and industry have effective water conservation and reuse programs which demand and use water supplies more efficiently; how to resolve effectively the constraints of water laws and rights on meeting water needs; whether Federal agencies' benefit-cost analyses fully and realistically consider the beneficial and adverse effects of water resource projects; whether water supply and water quality programs are being effectively coordinated; whether water research programs are making progress both in developing technology and in finding ways to increase the nation's water supply; whether conjunctive use of surface water with ground and saline water sources is adequately considered in meeting water needs; what problems are affecting the timely, efficient and economical construction of water resource projects; and whether cost-sharing requirements of Federal and federally-assisted water resources programs are viable today. These issues and concerns are studied in order to provide assistance to the Congress in its consideration of ways to solve the key water problems facing the nation. (Nessa-NC)  
W78-12665

**BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY. VOLUME II, ANNEX A: AGRICULTURAL REQUIREMENTS AND UPSTREAM WATERSHED DEVELOPMENT.**  
For primary bibliographic entry see Field 6B.  
W78-12769

## Field 6—WATER RESOURCES PLANNING

### Group 6D—Water Demand

**GROUND-WATER USE FOR NUCLEAR POWER PLANTS.**  
Bechtel, Inc., Gaithersburg, MD.  
For primary bibliographic entry see Field 3E.  
W78-12844

**PAYING FOR WATER - BY RATES OR CHARGES.**  
Water Pollution Research Lab., Stevenage (England).  
For primary bibliographic entry see Field 6C.  
W78-12882

### 6E. Water Law and Institutions

**A GUIDE TO THE NEW YORK STATE ENVIRONMENTAL QUALITY REVIEW ACT.**  
Cornell Univ., Ithaca, NY.  
E. G. Duvernoy.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 715.  
Price codes: A03 in paper copy, A01 in microfiche.  
Cornell University Center for Environmental Research, Ithaca, New York, March 1978. 38 p, 3 fig, 2 append. OWRT A-056-NY(5), 14-31-0001-5032, 6033, 7067 and 7068.

**Descriptors:** \*New York, \*Legislation, \*Environmental control, \*Environmental impact statement, Governments, Agencies, Environmental effects, Land resources, Water resources, Decision making.

Citizen concern for the quality of the nation's air, water, flora and fauna has led to the passage of much environmental legislation. The federal National Environmental Policy Act of 1969 (NEPA) was an innovative approach to environmental protection. The best known result of this Act is the environmental impact statement (EIS). All federal agencies contemplating an activity which significantly affects the environment must prepare an EIS describing the proposed activity, probable environmental effects, and agency plans to minimize environmental harm. The agency must circulate the EIS to other federal, state and local agencies and to the general public for review and comment. Circulation of impact statements to persons outside the agency has opened up the decision-making processes of federal agencies to the public, often resulting in less harm to the environment and in decisions which are more responsive to citizen concerns. Following NEPA and the success of the federal EIS process, many states passed similar statutes. In 1975, the New York legislature passed the State Environmental Quality Review Act (SEQR), which establishes a state EIS process. It requires government agencies in one of the most industrialized states in the country to consider possible environmental effects of their proposed actions. This booklet describes the purpose and responsibilities of, and the actions subject to, SEQR. The EIS process is detailed, the State Environmental Quality Review Act outlined, and DEC Type I and Type II Actions listed. SEQR's requirement that agencies consider the environmental implications of their activities should help conserve New York State's resources and increase its long-term productivity.  
W78-12104

**ISLAMIC WATER LAW WITH SPECIAL REFERENCE TO OASIS SETTLEMENT.**  
Oxford Univ. (England). School of Geography.  
J. C. Wilkinson.  
Journal of Arid Environments, Vol 1, No 1, p 87-96, March 1978. 50 ref.

**Descriptors:** \*Water law, \*Water rights, \*Islamic water law, Oases, Nomads, Arid lands, Deserts.

The basic principles of the Islamic water code are broadly based and applicable to a variety of hydrologic situations. Water is treated as a scarce

resource belonging to the community in its natural state and therefore the code opposes speculation, protects the rights of both nomadic and sedentary peoples, and attempts to establish an order for agricultural exploitation. The application of the code follows the spirit of fair dealings and allows for a wide variety of interpretations adapted to different techniques of water exploitation and systems of water distribution. The code's flexibility and the hydrologic knowledge on which it is based account for its acceptance by many different societies as a basis for voluntary water use regulation. (Russell-Arizona)  
W78-12212

**THE LEGALIZATION OF GROUNDWATER STORAGE.**  
Southern California Metropolitan Water District, Los Angeles.  
V. E. Gleason.  
Water Resources Bulletin, Vol 14, No 3, p 532-41, June, 1978. 1 fig, 16 ref.

**Descriptors:** \*Water law, \*Water rights, \*Appropriative rights, Legal aspects, \*California. \*Water storage, Aquifer management, Judicial decisions, Groundwater, Water supply.

California courts recently recognized underground aquifer storage rights that allow public agencies to store imported waters in aquifers, to prevent others from expropriating that water, and to recapture that water when it is needed. The two appellate decisions representing the common-law development of aquifer storage rights are discussed. One decision, entitled Niles Sand and Gravel Company vs Alameda County Water District 37 C.A. 3d 924 (1974), involved an aquifer managed under statutory authority, while the other, City of Los Angeles vs City of San Fernando 14 Cal. 3d 199 (1975), dealt with an aquifer managed under judicial authority. These decisions offer two rationales for aquifer storage rights: (1) to protect water supplies necessary for the overlying community, and (2) to increase water supply efficiency by using natural underground storage whenever possible. This paper analyzes the relationship between aquifer storage rights and conventional groundwater rights, indicating aspects of storage rights that need further development. (Russell-Arizona)  
W78-12218

**INTERRELATIONSHIP OF GROUND AND SURFACE WATER QUALITY IN THE EL PASO-JUAREZ AND MESILLA VALLEYS.**  
New Mexico State Univ., University Park. Coll. of Engineering.  
For primary bibliographic entry see Field 5B.  
W78-12225

**THE SALT BALANCE OF THE MEXICALI, B.C. IRRIGATION DISTRICT (EL BALANCE DE SALES DEL DISTRITO DE RIEGO DE MEXICALI, B.C.).**  
Escuela Nacional de Agricultura, Chapingo (Mexico). Dept. of Irrigation and Drainage.  
For primary bibliographic entry see Field 3C.  
W78-12226

**THE ECONOMIC DEVELOPMENT OF TIJUANA IN RELATION TO WATER SUPPLY AND ATMOSPHERIC, MARINE AND AQUATIC CONTAMINATION.**  
Sonora Univ., Hermosillo (Mexico). School of Law and Social Sciences.  
C. Cabrera Fernandez.  
Natural Resources Journal, Vol 18, p. 11-27, January 1978. 2 tab, 16 ref, English summary.

**Descriptors:** \*Urbanization, \*Water supply, \*Mexico, Water shortage, \*Colorado River, Tijuana, Aqueducts.

The lack of sufficient water is one of the major constraints on further development of Tijuana. Initially Tijuana's water supply came from wells in the Tijuana river bed, but by 1948 the supply was dependent on the Rodriguez Dam and shortages suspended local agricultural production. In the 1950's, a desalinization plant was built and wells were drilled to augment the supply and in 1974 Tijuana received water from Mexico's quota of Colorado River water. The Colorado-Tijuana River aqueduct, currently under construction, will provide for a population of 1 1/2-2 million, sufficient for about twenty years. (Russell-Arizona)  
W78-12227

**INTERNATIONAL RIVER COMMISSIONS AND THE INTERNATIONAL BOUNDARY AND WATER COMMISSION (LAS COMISIONES INTERNACIONALES Y LA COMISION INTERNACIONAL DE LIMITES Y AGUAS).**  
R. Cruz Miramontes.  
Natural Resource Journal, Vol 18, p. 111-129, January 1978. 26 ref, English summary.

**Descriptors:** \*International commissions, Mexico, \*International Boundary and Water Commission, International waters.

International river commissions such as those controlling major European and American rivers, arose as a means of shared water control amid the existence of political, economic and social inequalities. The International Boundary and Water Commission, created to handle water problems along the US-Mexican border has been particularly successful. Its functions have been defined and modified through many bilateral agreements, especially those of 1889, 1944, and 1970. It is now composed of two national sections and functions primarily in an administrative and jurisdictional capacity. To achieve better water use and conservation, the various commissions should advocate the creation of a World River Commission. (Russell-Arizona)  
W78-12228

**THE UPPER RIO GRANDE.**  
New Mexico State Univ., University Park. Dept. of Civil Engineering.  
J. W. Clark.  
Natural Resources Journal, Vol 18, p. 69-75, January, 1978. 7 ref.

**Descriptors:** \*Regional analysis, \*Water management (Applied), Data collections, Long-term planning, \*International waters, \*Mexico, Water resources development, Research priorities, \*Rio Grande River, Environment.

A historical background of the issue of surface water distribution between Colorado, New Mexico and Texas, and between Mexico and the United States, is offered to give some perspective on the problems of shared ground water allocation. A research program is proposed to provide data on which to base a regional environmental management plan. The research design should include (1) evaluation of attitudes, goals, and priorities of the region's residents, (2) evaluation of current environmental resource utilization and possibilities for renewing and enhancing them, (3) evaluation of the relationships between growth and environmental resources, (4) the study of the region's institutional structure, (5) development and application of data management techniques, (6) development of sociopolitical and economic management models to test different alternatives, and (7) development of a regional environmental management plan and a plan for its implementation. (Russell-Arizona)  
W78-12229

**INSTITUTIONAL ALTERNATIVES FOR MEXICO-U.S. GROUNDWATER MANAGEMENT.**  
City Univ. of New York.  
R. D. Hayton.

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**Descriptors:** \*Groundwater, International Mexico, W  
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## WATER RESOURCES PLANNING—Field 6

### Water Law and Institutions—Group 6E

Natural Resources Journal, Vol 18, p 201-212, January, 1978. 21 ref, Spanish summary.

**Descriptors:** \*Water management (Applied), \*Groundwater resources, Groundwater basins, International Boundary and Water Commission, Mexico, Water resources development, Water policy, Institutions, Rio Grande River, International waters.

While the principle of basin-wide, integrated management of both surface and groundwater is generally accepted, the legal pluralism existing in Mexico and the United States presents an obstacle to the sectorial management of shared resources at the international level. In the U.S., attempts to solve interstate water problems may provide institutional models with which to approach the task of considering the institutional aspects of international shared resource management. It is essential that international water resource agreements be modified to include guidelines for groundwater use. Recommendations are made to provoke discussion on the appropriate institutional means for handling common groundwater supplies. (Russell-Arizona) W78-12230

**INTERNATIONAL EXTERNAL DISECONOMIES: THE COLORADO RIVER SALINITY PROBLEM IN MEXICO**, Escuela Nacional de Agricultura, Chapingo (Mexico); and Colorado State Univ., Fort Collins. Dept. of Economics. F. Oyarzabal-Tamargo, and R. A. Young. Natural Resources Journal, Vol 18, p 77-89, January, 1978. 18 ref, Spanish summary.

**Descriptors:** \*Salinity, \*Saline waters, Irrigation waters, Model studies, \*Economic impact, Linear programming, International waters, Colorado River, Desalination plants, Water quality, Alternative planning.

Saline drainage water released from an irrigation district in the United States reduced productivity and income for farmers using Colorado River water for irrigation in Mexico. In this paper, linear programming models were used to quantify the extent of economic damage caused to producers from degraded water quality after the 1973 salinity agreements were signed. The estimated external cost, about 160 million pesos at 1975 prices, indicates that maintenance of low salt discharges is warranted. However, alternatives to the proposed desalting plant, such as direct compensation to Mexican interests or continuing to bypass Mohawk-Welton drainage waters, may be the most economical. W78-12231

**GROUNDWATER OCCURRENCE AND UTILIZATION IN THE ARIZONA-SONORA BORDER REGION**, Arizona Univ., Tucson. Dept. of Hydrology; and Arizona Univ., Tucson. Dept. of Geosciences. For primary bibliographic entry see Field 4B. W78-12233

**INSTITUTIONS FOR THE SOLUTION OF SURFACE WATER PROBLEMS BETWEEN MEXICO AND THE UNITED STATES (INSTITUCIONES PARA LA SOLUCION DE PROBLEMAS DE AGUAS DE SUPERFICIE ENTRE MEXICO Y LOS ESTADOS UNIDOS)**, Instituto Mexicano de Estudios Diplomaticos. C. Sepulveda. Natural Resources Journal, Vol 18, p 131-141, January, 1978. 8 ref, English abstract.

**Descriptors:** \*Legal aspects, \*Mexican water treaty, \*Mexico, \*International waters, \*International Boundary and Water Commission, Boundary disputes, Droughts.

While the 1944 treaty between Mexico and the United States was generally a good one, there remain several imprecise and potentially problematic points. One of these is the concept of 'extraordinary drought' and that of 'serious accident to the U.S. irrigation system'. In the case of extraordinary drought, the 1944 treaty specified that the U.S. could reduce the quantity of water sent to Mexico in the same proportion that water to American users is reduced. However, it is not specified whether the drought must be suffered by the entire basin or only part of it in order to qualify as an 'extraordinary drought'; nor was the intensity of duration of the drought defined. If difficult situations should arise as a result of this imprecision, the arbitrating capacity of existing institutions would be put to the test. While the International Boundary and Water Commission might provide voluntary arbitration between the two countries, its primary function is to offer and evaluate technical data rather than to resolve legal disputes. Alternatives include international arbitration and adjudication by the United Nations International Court of Justice. Weaknesses with both of these lead to the conclusion that diplomacy carried out through the International Boundary and Water Commission might be the best means of settling conflicts arising from imprecision in the treaty. (Russell-Arizona) W78-12234

**SUMMARY ANALYSIS OF THE NORTH AMERICAN (U.S. PORTION) OECD EUTROPHICATION PROJECT: NUTRIENT LOADING-LAKE RESPONSE RELATIONSHIPS AND TROPIC STATE INDICES**, Texas Univ., at Dallas, Richardson. Center for Environmental Studies. For primary bibliographic entry see Field 5C. W78-12245

**WATER RESOURCE POLITICS AND INTEREST GROUP TACTICS**, Whitman Coll., Walla Walla, WA.

K. M. Beatty, H. Doerksen, and J. C. Pierce. Water Resources Bulletin, American Water Resources Association, Vol. 14, No. 2, April 1978, (p 394-403); 2 tab, 20 ref. OWRT A-069-WASH(4).

**Descriptors:** Water resources, \*Institutional aspects, \*Water policy, \*Interest groups, \*Legal aspects, Water resources management, \*Political aspects.

The traditional strong role of interest groups in water resources policy making has been modified recently by the introduction of many environmental groups. The new groups differ from traditional groups in their relatively modest resources and their lack of access to traditional decision points. This paper examines the extent to which the new groups differ in their perceptions of the effectiveness of tactics and in their use of tactics, taking into account group resources and group access to decision makers. (Humrichhouse-Wash St) W78-12278

**PESTICIDES AND THE SOUTH AFRICAN POPULATION**, Department of Agricultural Technical Services, Pretoria (South Africa). For primary bibliographic entry see Field 5G. W78-12407

**SUMMARY OF FRESHWATER POLLUTION LEGISLATION IN SOUTH AFRICA**, Department of Planning and the Environment, Pretoria (South Africa). For primary bibliographic entry see Field 5G. W78-12412

**SOUTH AFRICAN COMPANY INVOLVED IN INTERNATIONAL WATER INJECTION CONSTRUCTION**. For primary bibliographic entry see Field 8B. W78-12418

**ENVIRONMENTAL CONTROL IN THE MINING INDUSTRY**. For primary bibliographic entry see Field 5G. W78-12459

**THE ROLE OF WATER DEVELOPMENT ADVISORY COUNCILS IN WATER RESOURCE PLANNING**, D. G. Purnell. Rhodesia Science News, (Salisbury) Vol 11, No 6, p 135-136. 1977.

**Descriptors:** \*Water resources, \*Planning, Water resources development, Legal aspects, Recommendations, \*Rhodesia, Africa.

One of the main objectives of the Ministry of Water Development is to ensure the optimum development and utilization of the water resources of Rhodesia as these are limited and therefore have to be managed effectively and efficiently. With this and other objectives in view, the former Water Act and subsequent amending acts were completely revised and republished as the Water Act 1976 which became law on 19th November, 1976. (So Afr Water Info Ctr) W78-12478

**INTERNATIONAL RIVER LAW AND THE RHODESIA WATER ACT 1976**, S. W. Loewenson. Rhodesia Science News, Salisbury, Vol 11, No 6, p 137, 143, 1977.

**Descriptors:** \*Legal aspects, \*River flow, \*International law, Water law, Drainage basins, \*Rhodesia, Africa.

There are two categories of international rivers, those that flow along the boundary separating two countries (called 'contiguous') and those that flow through one country into another (called 'successive'). International law does not draw legal distinctions between these two and ranks them on equal priority. Before the turn of the century, when rivers were used mostly for transport, international law was concerned with only the river and the water in the river in relation to its use for navigation. To-day it is recognized that rivers and their catchment areas serve many other functions in the promotion of national and regional development, so that international law now covers the whole of the river catchment systems, or drainage basin as it is sometimes called. (So Afr Water Info Ctr) W78-12479

**OUTER CONTINENTAL SHELF OIL AND GAS INFORMATION PROGRAM**. Geological Survey, Washington, DC. For primary bibliographic entry see Field 7C. W78-12555

**OUTER CONTINENTAL SHELF LEASING**. Bureau of Land Management, Washington, DC. For primary bibliographic entry see Field 5G. W78-12558

**INDEPENDENT RENDERING INDUSTRY EFFLUENT LIMITATION AND GUIDELINES**. Environmental Protection Agency, Washington, DC. For primary bibliographic entry see Field 5G. W78-12559

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

#### ALLOCATION OF WATER STORED FOR FLOOD CONTROL AND NAVIGATION PURPOSES (PROPOSED RULE).

Corps of Engineers, Washington, DC.  
Federal Register, Vol. 42, No. 191, p 53637-46, October 3, 1977, 5 tab.

Descriptors: \*Flood control, \*Water storage, \*Reservoir storage, \*Federal power act, Navigation, Regulation, Legislation, Federal government, Construction, Water control, Water allocation(Policy), Dams.

This rule proposed by the U.S. Army Corps of Engineers prescribes the policy and procedure for regulating certain reservoir projects for flood control or navigation and the use of storage allocated for such purposes and provided on the basis of flood control and navigation. These revised regulations are applicable to dam and reservoir projects which are licensed, maintained and operated under the Federal Power Act, and other similar pieces of legislation. They are equally applicable to reservoir projects constructed wholly or in part with federal funds pursuant to the Act. It is hoped that these proposed regulations will promote understanding among project owners, operating agencies and the Corps of Engineers regarding various activities and responsibilities concerning a national program of water control management in the interest of flood control and navigation. These regulations do not apply to projects owned and operated by the Corps of Engineers; the International Boundary and Water Commission (United States and Mexico); and those under the jurisdiction of the Columbia River Treaty. Several tables are included giving pertinent data for projects which are subject to this regulation. (Quarles-Florida)  
W78-12561

#### EXISTING SOURCES AND NEW SOURCE PERFORMANCE STANDARDS AND EFFLUENT LIMITATIONS AND GUIDELINES.

Environmental Protection Agency, Washington, DC.  
For primary bibliographic entry see Field 5G.  
W78-12562

#### ENVIRONMENTAL IMPACT REPORTS UNDER THE CALIFORNIA ENVIRONMENTAL QUALITY ACT: THE NEW LEGAL FRAMEWORK, San Diego Univ., CA. School of Law.

For primary bibliographic entry see Field 5G.  
W78-12563

#### THE WASTES ENDURE,

For primary bibliographic entry see Field 5B.  
W78-12564

#### RETHINKING THE TIMETABLE FOR REFRESHING OUR WATERS,

For primary bibliographic entry see Field 5G.  
W78-12565

#### AGENCY CREATED TO FIGHT COASTAL SUBSIDENCE MENACE, Harris-Galveston Coastal Subsidence District, Houston, TX.

J. E. De Berry.  
Water and Sewage Works, Vol. 124, No. 6, p 62-63, June, 1977, 2 fig.

Descriptors: \*Land subsidence, \*Texas, \*Surface groundwater relationships, \*Water wells, \*Well regulations, Available water, Decisionmaking, Elevation, Groundwater, Groundwater availability, Groundwater resources, Gulf coastal plain, Local governments, State governments, Subsidence, Surface waters, Water permits, Well permits, Wells, Withdrawal.

The Texas gulf coast has suffered increasingly from the loss of land surface elevation, resulting in millions of dollars of damage and increased vulnerability to hurricane and flood damage. This article focuses on the establishment and operation of the Harris-Galveston Coastal Subsidence District, which was designed to end subsidence in the area. The District is governed by a 15-member board of directors appointed by local government officials. Under the provisions of the act creating the district, each water well within the district with a diameter greater than five (5) inches must receive a permit from the Board. Regulation of the amount of water withdrawn from the wells is the means by which the District controls subsidence. In reviewing permit applications, the Board considers, among other factors, the economic impact on the applicant, the relative effect on subsidence, and the quality, quantity, and availability of surface water at competitive costs. A plan to regulate groundwater withdrawal has also been formulated for the District. The effect of such regulation, if any, upon area subsidence will be determined from measurements of land elevation losses made by the U.S. Geological Survey. (White-Florida)  
W78 12566

#### TOXIC POLLUTANTS CONTROL: PROGRESS AT LAST,

For primary bibliographic entry see Field 5G.  
W78-12567

#### PUBLIC INVOLVEMENT IN NATURAL RESOURCE DEVELOPMENT: A REVIEW OF WATER RESOURCE PLANNING, Virginia Polytechnic Inst. and State Univ., Blacksburg, Div. of Environmental and Urban Systems.

G. A. Daneke.  
Environmental Affairs, Vol. 6, No. 1, p 11-13, 1977.

Descriptors: \*Water resources, \*Water policy, \*Project planning, \*Planning, Natural resources, Legal aspect, Public utility districts, Environmental control, Political aspects, Local governments, Water resources development, Alternative planning, Benefits, Decision making, Public benefits, Public rights, Water users.

There exists today general agreement that citizen involvement in environmental policy-making must be increased, but the efforts being made are unclear and lack planning. However, public concern and legislative commitment has made this area a focal point for the participatory movement. This article traces three approaches to public involvement in natural resources development. Traditional planning saw water planning and policy-making as basically decentralized processes dependent upon local support with an environmental movement blossoming in response to the 'growth syndrome'. Fishbowl planning involves a few selected citizens in policy-making by adding citizens' committees to water resources agencies. Both the traditional and fishbowl methods tend to isolate and polarize conflicting interest groups. The third approach, Alternative Participatory Technology, stresses integrating reluctant publics into the planning process. Recommendation on how to accomplish this include: (1) alerting affected publics to the benefits and burdens of participation, (2) underwriting the informational investment, (3) conducting workshops in organizational skills and (4) providing financial inducements similar to those granted to jurors. Although establishing broader based negotiations is no guarantee that polarized interests will agree, planning agencies will have a wider spectrum of interests from which to construct coalitions and force legislative action. (Spector-Florida)  
W78-12568

#### RULES AND REGULATIONS GOVERNING WATER WELLS IN FLORIDA.

Florida State Dept. of Environmental Regulation, Tallahassee, Div. of Environmental Permitting, Fla. Admin Code, Ch 17-21, secs 21.01 thru 21.13 (1978), 1 tab.

Descriptors: \*Florida, \*Groundwater resources, \*Well regulations, \*Well permits, Groundwater, Water management(Applied), Water wells, Permits, Environmental control, Water districts, Standards, Legislation.

These regulations are intended to effectuate the powers and the duties of the Florida Department of Environmental Regulation (DER) under the section of the state statutes establishing Water Management Districts. These DER rules govern water wells in Florida. The first part describes a water well permitting system to be administered and enforced by the Water Management Districts upon delegation by DER. The second part establishes minimum water well construction standards designed to conserve Florida's ground water resources. The final section specifies the Florida Statutes which provide for enforcement and penalties of these regulations. Since geology and hydrology vary throughout the state, the various Districts are given authority to adopt any consistent regulations in order to better protect local ground water resources. In general, these regulations provide that no person shall construct, repair, or abandon any water well contrary to the relevant statutes. Prior permission is required for construction of wells intended to be used for artificial recharge of ground water, or for the intentional introduction of water into any underground formation, or for repair or abandonment of any such well. (Quarles-Florida)  
W78-12569

#### KEY V. LOUISIANA DEPARTMENT OF HIGHWAYS (COMPENSATION FOR DAMAGES TO PRIVATE LAND CAUSED BY STATE'S WIDENING OF HIGHWAY UPHLED).

357 So. 2d 1230-34 (La. Ct. App. 1978).

Descriptors: \*Louisiana, \*Eminent domain, \*Flood damage, \*Alteration of flow, Damages, Construction, Highways, Silting, Drainage, Flood flow, Condemnation, Natural flow.

Defendant, Louisiana Department of Highways, brought this appeal from a lower court decision awarding damages to plaintiff private landowner in an inverse condemnation action. The award was based on a finding that plaintiff's damages were caused by defendant's widening a nearby highway. Plaintiff's property was subject to a servitude of natural drain from land south and east of the property. In connection with the highway project, defendant removed large amounts of dirt, a house on an adjacent lot, and a concrete elevation which had acted as a partial diversion of drainage water from plaintiff's lot. Plaintiff's property subsequently sustained flooding and silting damage. Plaintiff was forced to construct drainage facilities. Defendant contended on appeal that it was not liable and that the damage award was excessive. Affirming the decision, the Louisiana court of appeal held that plaintiff was entitled to compensation for damages and that the evidence supported an award of damages in the nature of the cost of cure. However, plaintiff was not entitled to an award for depreciation in property value nor to damages for mental anguish. (Quarles-Florida)  
W78-12570

#### BERKLEY V. STATE DEPARTMENT OF ENVIRONMENTAL REGULATION (CONSTRUCTION IN BISCAYNE BAY APPROPRIATE UNDER THE COMPREHENSIVE FLORIDA AQUATIC PRESERVE ACT).

358 So. 2d 552-56 (1st D.C.A. Fl. 1978).

Descriptors: \*Land development, \*Aquatic habitat, Legislation.

In this appeal, an order of Environmental Regulation application to fill his land which was comply with Act—was the filling quality of statutes (the land of the FL court of tioner's a permit. T was priv establish Biscayne exclusion Aquatic apply, D way beo preserve W78-12571

MINNEAPOLIS V. HOKA WATER ACT).

449 F. S.

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Descriptors: \*Florida, \*Landfills, \*Permits, \*Land development, Construction, Sea walls, Aquatic habitats, Bays, Riprap, Navigable waters, Legislation.

In this appeal, petitioner-private landowner challenged an order of respondent Florida Department of Environmental Regulation (DER), denying his application for a permit to construct a seawall and fill his lands. Petitioner contended his application—which was denied on the ground that it did not comply with the Biscayne Bay Aquatic Preserve Act—was erroneously denied. Petitioner insisted the filling was necessary to enhance the utility and quality of the preserve. DER argued that Florida statutes excluded the Biscayne Aquatic Preserve (the land at issue), from being within the purview of the Florida Aquatic Preserve Act. The state court of appeal quashed the order denying petitioner's application and directed DER to grant the permit. The court held that where petitioner's land was privately owned and lying landward of an established bulkhead, it was not subject to the Biscayne Bay Aquatic Preserve Act by reason of exclusion under the Comprehensive Florida Aquatic Preserve Act. If the former act was to apply, DER should have granted the permit anyway because the project would enhance the preserve. (Quarles-Florida) W78-12571

#### MINNEHAHA CREEK WATERSHED DISTRICT V. HOFFMAN (DEFINITION OF NAVIGABLE WATER UNDER THE RIVERS AND HARBORS ACT).

449 F. Supp. 876-86 (D. Minn. 1978).

Descriptors: \*Minnesota, \*Rivers and Harbors Act, \*Federal Water Pollution Control Act, \*Judicial decisions, State governments, Lakes, Regulation, Permits, Navigable waters, United States, Dams, Dam construction.

Plaintiffs, two political subdivisions of Minnesota, brought an action seeking injunctive relief from regulatory jurisdiction asserted by defendant, the U.S. Army Corps of Engineers, over Lake Menneka. The Minnesota Department of Natural Resources intervened as a plaintiff who sought a declaration that permits issued by defendant were invalid insofar as they conflicted with state and local regulations. Plaintiffs contended the lake and its outlet were not navigable waters of the United States as defined in the federal Rivers and Harbors Act. They insisted that the regulations promulgated by the defendants under the Federal Water Pollution Control Act were invalid because they regulated activities beyond the purview of the Act. The United States District Court stated that defendant's rationale for their determination of navigability was not binding on the court. The court held that the lake was not a navigable water under the Rivers and Harbors Act because it was located entirely within the state and because it formed no navigable interstate waterway connection. The court also held that defendant's regulation of riprap placement and dam construction was unavailable under the Federal Water Pollution Control Act. W78-12572

#### UNITED STATES V. STATE OF CALIFORNIA (CALIFORNIA HAS DOMINION OVER SUBMERGED ISLANDS AND WATER WITHIN THE AREA SURROUNDING SANTA BARBARA ISLANDS IN THE CHANNEL ISLANDS NATIONAL MONUMENT).

98 S. Ct. 1662-70 (1978).

Descriptors: \*California, \*Federal-state water rights conflicts, \*Submerged lands act, \*Parks, State governments, United States, Federal government, Islands, Navigable waters, Shores, National monuments.

Plaintiff United States government brought this action seeking a determination of whether plaintiff

or defendant state of California had dominion over the submerged islands and water within the one-mile belts surrounding Santa Barbara and Anacapa Islands within the Channel Islands National Monument. In 1949 the Monument was enlarged by Presidential Proclamation to encompass areas within one nautical mile of the shorelines of these islands. The submerged lands and waters within the one-mile belts was deemed to be under federal dominion as a result of a 1947 United States Supreme Court decision. Both plaintiff and defendant concentrated their arguments on the issue of Presidential intent in the use of the word 'areas' in the proclamation. However in this case, the United States Supreme Court, having original jurisdiction, concluded that this issue was irrelevant. After a consideration of the history of the controversy, the Court concluded that, regardless of past litigation, the dominion over the area at issue was vested in the defendant state by the 1953 Submerged Lands Act, one purpose of which was to undo the Court's earlier (1947) opinion. (Quarles-Florida) W78-12573

#### STATE V. A. CAPUANO BROS., INC. (RHODE ISLAND'S FRESH WATER WETLANDS ACT HELD CONSTITUTIONAL).

384 A. 2d 610-15 (R.I. 1978).

Descriptors: \*Rhode Island, \*Wetlands, \*Landfills, \*Permits, Land, Regulation, Reasonable use, Compensation, Beneficial use, Eminent domain, Legislation, Navigable waters.

Plaintiff state appealed a lower court's refusal to grant injunctive relief and assess a civil penalty against defendant landowners for alleged violations of the Rhode Island Fresh Water Wetlands Act. Plaintiff contended defendants altered fresh water wetlands without the approval of the state Department of Resources (Department). Plaintiff maintained that defendants must: halt further filling without a permit; restore the altered wetland's to their prior condition; and, pay a civil penalty. Defendants submitted an application to alter their wetlands. The Department concluded that the Act was inapplicable and that no permit was required provided no extension of fill occurred in any direction. Later, the Department informed defendants that an application would be required to extend the fill. Defendants contended the Act was unconstitutional, and also that the state failed to prove that the property was a wetland. The Rhode Island Supreme Court held that the Act was not unconstitutional on the theory that it failed to provide notice to landowners, and that it did not deprive them of reasonable use of their property without just compensation. The Court also held that the property was wetland subject to the Act. (Quarles-Florida) W78-12574

#### PIERCE V. RILEY (RIGHT OF RIPARIAN LANDOWNERS TO PROHIBIT EASEMENTS FOR LAKE ACCESS TO NONRIPARIAN OWNERS UPHOLD).

264 N.W. 2d 110-15 (Mich. Ct. App. 1978).

Descriptors: \*Michigan, \*Easements, \*Riparian rights, \*Reasonable use, Right-of-way, Lakes, Riparian land, Channels, Marinas, Dredging, Inland waterways, Watercourses (Legal aspects).

Plaintiff, lake property owners, sought to enjoin other lake property owners from granting easements for lake access to nonriparian owners of a marina development. Plaintiffs' complaint was dismissed twice at the trial court level. This was the fourth time that the case was brought before the Michigan Court of Appeals, which earlier had reversed the circuit court and enjoined the granting of riparian rights to the nonriparian owners. The appeals court had also ordered the filling of a dredged channel in a riparian lot. On appeal to the state Supreme Court, the cause was ordered held

in abeyance pending a decision on the problem by the state Department of Natural Resources (DNR). Relying on the DNR opinion, the circuit court imposed restrictions on the lot's use as a marina. On this appeal of the restricted-use order, the Court of Appeals held that where the proposed use of the channel would interfere with rights of riparian owners, it should be filled. The court decided that the question of reasonableness of use of the riparian lot as the site of a dredged channel was not subject to its review. (Quarles-Florida) W78-12575

#### CITY OF COLUMBUS V. TEATER (BALANCING RIGHTS OF OHIO MUNICIPALITIES WITH THE STATE INTEREST OF CONSERVING NATURAL RESOURCES).

374 N.E. 2d 154-60 (Ohio 1978).

Descriptors: \*Ohio, \*Watercourses (Legal aspects), \*Water resources, \*Rivers, Local governments, State governments, Construction, Utilities, Channels, Water supply, Aesthetics, Preservation.

Plaintiff, an Ohio municipal corporation, brought an action against the director of the state Department of Natural Resources. Plaintiff challenged the constitutionality of a statute providing that no subdivision of the state may build or modify channels of any watercourse within a scenic river area outside the limits of municipal corporations without approval from the director. The trial court ruled in favor of the plaintiff. Pursuant to the statute at issue, defendant manifested an intent to designate part of the Big Darby Creek a scenic river area and notified plaintiff of such action. The creek section to be so designated was undisputedly outside the municipal corporation's boundaries. Plaintiff instituted a program for the construction, operation and maintenance of a water supply reservoir to be located on the creek in the area of proposed designation by defendant. Defendant contended that the preservation of the state's rivers was a valid exercise of state police power. On appeal, the Ohio Supreme Court reversed the trial court and found for the defendant. The court held that the statute at issue was not facially violative of the state constitution. (Quarles-Florida) W78-12576

#### MYOTTE V. VILLAGE OF MAYFIELD (UPPER RIPARIAN LANDOWNER LIABLE FOR DAMAGES CAUSED BY INCREASED WATER FLOW ONTO LOWER RIPARIAN LAND).

375 N.E. 2d 816-21 (Ohio Ct. App. 1977).

Descriptors: \*Ohio, \*Floods, \*Surface drainage, \*Riparian land, Damages, Drainage area, Local governments, Surface waters, Water utilization, Flow, Watercourses (Legal aspects), Permits.

Plaintiff, lower riparian landowner, successfully sought compensation for flood damage following development of an industrial park permitted by and financially beneficial to defendant village. Plaintiff owned land situated at the northeast end of a watershed which drained in a northeasterly direction. During heavy rains, plaintiff's land experienced flooding by way of a watercourse which ran through the property. After the development of the industrial park south of plaintiff's property, substantial flooding occurred following any rainfall. Plaintiff contended that defendant was liable for flood damage caused by its actions that permitted the replacing of a portion of the preexisting watercourse with storm sewers. Defendant maintained that the flooding could be eliminated if plaintiff replaced a small culvert on plaintiff's property with a larger pipe in order to allow the natural flow of water. On defendant's appeal, the Ohio Court of Appeals affirmed plaintiff's damages and held that where a lower riparian landowner stands to be seriously injured by the increased flow of surface water from an upper riparian estate, the upper riparian landowner should be liable for



## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

damages, especially when they could have prevented the damage with little expense. (Quarles-Florida)  
W78-12577

**ULLIAN V. CULLEN (CHANNELS EVOLVED INTO NATURAL WATERCOURSES IN MASSACHUSETTS).**  
373 N.E. 2d 359-62 (Mass. App. 1978).

Descriptors: \*Massachusetts, \*Surface drainage, \*Channels, \*Obstruction to flow, Surface runoff, Channel flow, Natural flow, Watercourses (Legal aspects), Drainage, Culverts, Surface waters.

Plaintiff, landowner, sought to restrain defendants, adjoining landowner and leasor, from obstructing a watercourse which carried flow of surface water from plaintiff's property. Defendants leased part of their land to a town to be used as a sanitary landfill. At defendants' instruction an agent of the town filled a culvert which had been in place since World War I. This substantially restricted the flow of water through it, causing water from two channels located on plaintiff's land to back up and flood part of plaintiff's land. The master's findings indicated that the two channels on plaintiff's land met the basic criteria for a natural watercourse. The main issue appeared to be whether this finding of the lower court—subsequently adopted by the lower court—was warranted by the subsidiary findings of the master. Upon defendant's appeal, the Massachusetts Appeals Court held that the channels at issue were not artificial ditches but, rather, constituted natural watercourses since the channels were formed by the natural flow of surface water. Thus, over the years, they had evolved into natural watercourses. (Quarles-Florida)  
W78-12578

**WASHTENAW COUNTY V. SALINE RIVER INTERCOUNTY DRAINAGE BOARD (REQUIREMENT OF BONDS WITH PETITIONS FOR ESTABLISHING INTERCOUNTY DRAINS IN MICHIGAN).**  
264 N.W. 2d 53-58 (Mich. Ct. App. 1978).

Descriptors: \*Michigan, \*Drainage programs, \*Watercourses (Legal aspects), \*Rivers, Local governments, Flood plains, Legislation, Drains, Construction, Drainage area, Drainage.

Plaintiffs, a Michigan town and city, sought to enjoin defendants, intercounty drainage boards, from establishing the Saline River as an intercounty drain. After losing at the trial court level, defendants brought this appeal. Several townships submitted a petition to establish and construct the river as an intercounty drain. Pursuant to statute, the defendant drainage boards were created, hearings were held and an order to commence was issued. Plaintiffs contended the petition, being filed pursuant to Section 541 of the State Drain Code, did not contain an agreement to pay, nor was it accompanied by a deposit for the cost of engineering, as required by statute. Defendants maintained these procedures were unnecessary since the petition was filed pursuant to section 513, not section 541. A section 541 petition purports to assume jurisdiction over the river while section 513 only relates to the establishment of the river as an intercounty drain. The Michigan Court of Appeals reversed the trial court and held that absent a request for complete control of the river, a petition to establish an intercounty drain did not require an agreement or deposit. (Quarles-Florida)  
W78-12579

**HALSTEAD V. FARMERS IRRIGATION DISTRICT (NEBRASKA IRRIGATION DISTRICTS LIABLE FOR SEEPAGE DAMAGE REGARDLESS OF A SHOWING OF NEGLIGENCE).**  
263 N.W. 2d 475-78 (Neb. 1978).

Descriptors: \*Nebraska, \*Damages, \*Canal seepage, \*Irrigation districts, Floods, Seepage, Canals, Irrigation canals, Irrigation operation and maintenance, Negligence, Judicial decisions, Penalties (Legal).

Plaintiff, farmland lessee, brought this appeal after his action seeking damages for crops destroyed by seepage from an irrigation canal owned by the defendant irrigation district was dismissed. The land which the plaintiff leased was located within the boundaries of the defendant district. Plaintiff contended defendant was liable for seepage damage within its boundaries even though negligence was not present. Defendant argued it was not liable for such damage absent a showing of negligence. On this appeal to the Nebraska Supreme Court, the court found for the plaintiff and held that irrigation districts organized under Chapter 46 of the Nebraska statutes are liable for seepage damages without regard to negligence. The court based its decision primarily on the state Constitution. In so holding, the court overruled an earlier case which rested on the theory that every landowner within an irrigation district has knowingly and intentionally waived his constitutional right to damages. The court reasoned that such a theory was unrealistic. The case was reversed and remanded for further proceedings. (Quarles-Florida)  
W78-12580

**TITLE TO RIPARIAN ACCRETIONS AND ISLANDS.**

N.D. Cen. Code Ann. secs. 47-06-05 thru -10 (1960), as amended (Supp. 1977).

Descriptors: \*North Dakota, \*Accretion (Legal aspects), \*Avulsion, \*Land forming, Rivers, Streams, Banks, Streambeds, Islands, Navigable waters, Non navigable waters, Riparian land.

In North Dakota, where land accretion occurs upon the bank of a river or stream, navigable or non navigable, such land becomes the property of the owner of the bank, subject to any existing right-of-way over the bank. Where part of a river or stream bank is removed through the process of avulsion, and that part is born to the opposite bank or to another part of the same bank, the owner of the part carried away may reclaim it within a year after the owner of the land to which it has been united takes possession of it. Where a stream forms a new course, abandoning its old bed, the owners of the land newly occupied take by indemnity the old abandoned bed. Land formed in navigable stream beds belongs to the state, if there is no title or prescription to the contrary. The power of management of these lands is in the board of university and school lands with derived income to be used to defray general expenses of state government. Land formed in nonnavigable streams belongs to the shore owners. (Quarles-Florida)  
W78-12581

**APPROPRIATION OF WATER.**

N.D. Cen. Code Ann. secs 61-04-01 thru -22 (1960), as amended (Supp. 1977); secs 61-04-23 and -24 (Supp. 1977).

Descriptors: \*North Dakota, \*Appropriation, \*Preferences (Water rights), \*Legislation, Beneficial use, Water rights, Permits, Water delivery, Surplus water, Prescriptive rights, Diversion, Water utilization.

Beneficial use is the basis, the measure, and the limit of the right of use water in North Dakota. With certain exceptions, a person must secure a water permit from the state engineer before appropriating any water in the state. The form and procedure for filing applications for permits to make beneficial use of waters in the state are provided in this statute. After filing for an appropriation permit an applicant is required to give notice

to surrounding landowners and also to publish notice of the application in a newspaper. After a hearing the state engineer issues the permit if he finds: (1) a prior appropriator's rights will not be unduly affected; (2) the proposed means of diversion or construction are adequate; (3) the proposed water use is beneficial; and (4) the proposed appropriation is in the public interest. In regard to competing applications for water from the same source, the order of priority is: (1) domestic; (2) municipal; (3) livestock; (4) irrigation; (5) industrial; and (6) recreational. Priority in time is given the superior water right. Prescriptive water rights are exempted from permitting. Applications for use or point of diversion changes proceed in the same manner as appropriation permits. (Quarles-Florida)  
W78-12582

**FLORIDA ENVIRONMENTAL LAND AND WATER MANAGEMENT ACT.**  
Florida Environmental Land and Water Management Act.

Fla. Stat. secs. 380.012 - .12 (1977).

Descriptors: \*Florida, \*Water management (Applied), \*Land development, \*Legislation, Natural resources, Environment, Water quality, Water utilization, Land management, Permits, Water storage, Environmental control.

The state of Florida establishes its land and water management policies to coordinate local decisions relating to development while preserving the existing rights of private property. This is deemed necessary in order to protect the state's natural resources, and to reverse the deterioration of water quality and provide optimum utilization of limited water resources. The state land planning agency is given the power to exercise general supervision of the administration and enforcement of this act. The agency (or any regional planning agency) may recommend to the Administration Commission specific areas of critical state concern. In order to accomplish the purposes of this act, the Big Cypress Area of Florida is designated as an area of critical state concern. It is the intent of the legislature for the state and the federal government to engage in an agreement to acquire the area designated as the Big Cypress National Preserve. The procedure to be used in determining the regional impact of developments is set forth. The Land and Water Adjudicatory Commission is created by the act for the purpose of allowing appeals from decisions granting or denying permission to develop. (Quarles-Florida)  
W78-12583

**METROPOLITAN SEWERAGE DISTRICTS.**

Wisc. Stat. Ann. secs. 66.20 thru 66.24 (Supp. 1977).

Descriptors: \*Wisconsin, \*Sewage districts, \*Sewerage, \*Legislation, Local governments, Solid wastes, Sewage, Sewage disposal, Sewage treatment, Sewers, Storm water, Drainage.

The establishment of metropolitan sewerage districts is provided for by Wisconsin law. The procedure to be followed in the creation of a district is set forth. The district is given corporate status and is authorized to sue and to be sued. Each district is to be governed by a five member commission with individual commissioners appointed by the county board for staggered five-year terms. The procedures relevant to appointment, compensation and other matters relating to the commission are set forth in the act. The commission is to prepare and adopt standards of planning, design and operation for all projects operated by the district. The commission may engage in research on treatment processes and adopt rules for the management of district facilities. The commission is responsible for the collection and transmission of sewage within the district. The commission must regulate connections with the sewage system and may acquire property to

facilitate the operation of the system. The commission is authorized to construct (when necessary) and assume ownership of, existing utility works and facilities. The commission is also responsible for storm water drainage and solid waste management. (Quarles-Florida)  
W78-12584

#### COUNTY WATER AND SEWER DISTRICT LAW.

Fla. Stat. secs. 153.50 thru .95 (1977).

Descriptors: \*Florida, \*Sewage disposal, \*Sewer districts, \*Legislation, Population, Water supply, Public health, Sewage, Construction, Water law, Local governments, Facilities.

As a result of the extensive growth of population throughout Florida, public health and water supply problems have arisen. In many unincorporated county areas in the state, the population is not served by water and sewer facilities normally provided by municipalities, their agents or private persons. In view of the dire need for such facilities, it is the purpose of this act to provide means for county governments to alleviate such conditions in their unincorporated areas. The statute provides that the board of county commissioners in any county may establish one or more water and sewer districts as necessary in the public interest. An alternative method of establishing a district is provided whereby a petition signed by persons owning not less than 10 percent of the property within the boundaries of the proposed district is to be filed with the county property appraiser. The procedure to be followed in the creation of a district is set forth. The district has the power to construct and maintain a water and a sewer system. The district may also fix and collect rates. (Quarles-Florida)  
W78-12585

#### KRAFT V. LANGFORD (LIABILITY FOR DIVERSION OF SURFACE WATERS IN TEXAS PREDICATED ON PERMANENCY OF INJURY AND OWNERSHIP OF LAND).

565 S.W. 2d 223-30 (Tex. 1978).

Descriptors: \*Texas, \*Diversion, \*Drainage effects, \*Natural flow, Drainage, Real property, Compensation, Storm drains, Discharge(Water), Surface waters, Damages, Land development.

Plaintiff, landowner, brought suit against developers and engineer for damages resulting from wrongful diversion of surface water onto plaintiff's land. Plaintiff owned a tract of land in Texas which was bordered in part by defendant's land. A small drainage channel on the two tracts drained excess rainwater from the land. Subsequently, defendants developed their tract into a subdivision. The defendant engineer was hired for this project. He constructed a storm sewer which drained the entire subdivision and, following the course of the natural drainway, discharged an increased amount of water onto plaintiff's land. Following a jury verdict for the plaintiff, defendants appealed. The case was then reversed and remanded for retrial. Upon appeal of the retrial order, the Texas Supreme Court affirmed the reversal in favor of defendants. The Court held that the injuries should be characterized as a temporary injury and the landowner was not entitled to permanent damages. Also, the landowner had no course of action under the statute prohibiting diversion of the natural flow of surface waters against the engineer because he owned no interest in the tract which unlawfully diverted the surface water. (Quarles-Florida)  
W78-12586

#### NATIONAL RESOURCES DEFENSE COUNCIL, INC. V. COSTLE (STANDARDS GOVERNING ISSUANCE OF NATIONAL POLLUTION

#### DISCHARGE ELIMINATION SYSTEM PERMITS).

568 F. 2d 1369-83 (D. C. Cir. 1977).

Descriptors: \*Federal Water Pollution Control Act, \*Regulation, \*Permits, \*Wastewater(Pollution), Standards, Discharge(Water), Water pollution, Water pollution control, Administrative decisions, Legal review, Water pollution sources, Water quality, Judicial decisions, Impact(Rainfall), Administration, Environment, Administrative agencies, Water law, Water permits, Runoff, Rain.

Plaintiffs sought to have Environmental Protection Agency (EPA) regulations promulgated under the Federal Water Pollution Control Act (FWPCA) declared unlawful. The regulations concerned both the discharge of rainfall runoff which picks up pollutants as it drains over terrain into navigable waters, as well as exempted categories of point sources from National Pollution Discharge Elimination System (NPDES) permit requirements. The defendant argued that Section 402 of the FWPCA Amendments of 1972 gave the EPA discretion to exempt point sources from NPDES permit requirements. Despite the deference accorded to agency construction of new statutes, the Fifth Circuit Court of Appeals held that Congress intended permits to be required in all situations of pollution discharge from point sources. The court also rejected defendant's administrative infeasibility arguments and held: (1) that national effluent limitations are not always necessary for individual permitting despite the difficulty of promulgating special effluent limitations; (2) that permit conditions proscribing practices which increase pollution may be required when numerical limitations are infeasible; and (3) that area wide permits and other means are available to reduce administrative burdens. The court noted that EPA does have exclusive power to define 'point sources'. (Hoofman-Florida)  
W78-12587

#### SOUTH SANTA CLARA VALLEY WATER CONSERVATION DISTRICT V. SANTA CLARA VALLEY WATER DISTRICT (WATER DISTRICT ALLOWED OVERLAPPING YET NON-INTERFERING EXISTENCE WITH WATER CONSERVATION DISTRICT).

143 Cal. Rptr. 193-99 (Ct. App. 1978).

Descriptors: \*California, \*Permits, \*Water districts, \*Supervisory control(Power), \*Water management(Applied), Administrative agencies, Administrative decisions, Well permits, Wells, Governments, Legislation, Local governments, Construction, Judicial decisions, Legal aspects, Regulation, Water conservation, Water districts.

Plaintiff water conservation district and defendant water district have overlapping jurisdictions and both claimed the right to control construction and sealing of wells within their mutual territory. Defendant was empowered by ordinance to authorize all such construction within a countywide area. Plaintiff alleged that defendant district was precluded from exercising authority in plaintiff's territory without plaintiff's consent. The lower court granted summary judgment to the defendant and the plaintiff district appealed. In reversing, the appellate court held that: (1) the legislature possessed the power to extend defendant's boundaries countywide so that the defendant's and plaintiff's jurisdiction overlapped. The court found that the legislature has plenary power over districts organized for reclamation purposes. However, (2) since the legislature had specifically provided that the subsequently created defendant district could not condemn any of plaintiff district's structures, including those 'hereafter' constructed or acquired, the water district could not preclude plaintiff district from constructing or sealing wells within its own territory. (Baumbach-Florida)  
W78-12588

#### ENVIRONMENTAL DEFENSE FUND, INC. V. COSTLE (ADEQUACY OF ENVIRONMENTAL IMPACT STATEMENT FOR CONSTRUCTION OF OCEAN OUTFALL SERVERS IN LONG ISLAND, NEW YORK).

439 F. Supp. 980-1013 (E.D.N.Y. 1977).

Descriptors: \*Federal Water Pollution Control Act, \*New York, \*Outfall sewers, \*Environmental effects, Legislation, Water policy, Sewage disposal, Waste disposal, Cesspools, Septic tanks, Water law, Judicial decisions, Saline water intrusion, Balance of nature, Commercial shellfish, Shellfish farming, Sewers, Pollutants, Sewage treatment.

Plaintiffs, eight non-profit environmental organizations, sought declaratory and injunctive relief against the Environmental Protection Agency (EPA) and officials of the state of New York to stop the construction of sewage treatment facilities. Plaintiffs alleged violations of the 1969 National Environmental Policy Act (NEPA) and the Federal Water Pollution Control Act (FWPCA). Defendants maintained that because of increasing population in the Long Island area and corresponding increase in quantities of sewage, additional sewage treatment or disposal facilities are needed. To meet this need the defendants decided to employ ocean outfall pipes which awaiting technological developments that would enable safe recharge of waste water. Plaintiffs charged that the EPA did not adequately identify and evaluate alternative solutions as required by NEPA. The Eastern District Court of New York concluded that the Environmental Impact Statement (EIS) involved complied with the requirements of NEPA. The court also concluded that the defendants did comply with the requirements of the FWPCA. However, the court did order the filing of a supplemental EIS because the original EIS did not adequately address the effect of the project on the shellfish industry. (Stump-Florida)  
W78-12589

#### GROUND WATER AND WELLS.

S.D. Comp. Laws Ann. secs 46-6-1 thru 46-6-23 (1967).

Descriptors: \*South Dakota, \*Groundwater, \*Well permits, \*Drilling, \*Well regulations, Groundwater resources, Water sources, Subsurface waters, Groundwater movement, Artesian wells, Seepage, Subsurface runoff, Water level fluctuations, Water wells, Supply, Wells, Well casings, Regulation, Well spacing, Administrative agencies, Water conservation.

Anyone claiming a vested right to groundwater for non-domestic use must file a claim which the commission describing the use to which the water has been applied. Anyone wishing to appropriate groundwater for non-domestic purposes must notify the commission of the well's location and the amount and use of the water desired. Proposed wells must not interfere with established wells. Upon complaint, the commission will judge the question of interference. Parties aggrieved by the commission's decision may appeal to the circuit court. Well drillers must pay a fee and obtain an annually renewable license to drill from the commission. The license is subject to revocation if poor construction methods are used. The commission shall specify methods of well construction to prevent waste. Drillers must notify the Commission of intent to drill and keep accurate records of well drilled. The use of water must be reasonable; waste is prohibited. Uncontrolled wells must be reported to the commission. The commission must plug abandoned and wild wells. The commission shall make additional rules and regulations governing well construction when it is in the public's best interest. Penalties for non-conformance are described in the statute. (Beamer-Florida)  
W78-12590

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

#### CONTROL OF HISTORIC PROPERTY.

R.I. Gen. Laws secs 42-45, 1-3 thru 42-45, 1-5 (1976 Supp).

Descriptors: \*Rhode Island, \*Archaeology, \*Regulation, Administrative agencies, Legal aspects, Legislation, Navigable rivers, Navigable waters, \*Ownership of beds, Paleohydrology, Permits, Planning, State governments, Investigations, State jurisdiction, Water law.

The State of Rhode Island reserves to itself the exclusive right and privilege of field investigation on sites owned or controlled by the state in order to protect and preserve archaeological and scientific information, matter, and objects. Subject to any local, state or federal statute, the title to all bottoms of navigable waters within the state's jurisdiction in the territorial sea, and the title to any underwater historical properties lying on or under said bottoms of any other navigable waters of the state, is declared to be in the state. Such bottoms and underwater historical properties shall be subject to the exclusive dominion and control of the state. The state historical preservation commission shall be the agency responsible for administering the archeology and underwater archeology programs. The commission is empowered to prescribe such rules and regulations as may be necessary to preserve and protect underwater historic properties and specimens derived from archeological sites. Any person conducting field investigations shall be responsible for obtaining permission of any federal or state agencies having jurisdiction prior to conducting any recovery operation. Title to all objects and specimens recovered shall be retained by the state. (Jordan-Florida) W78-12591

#### TEXAS CTY IRRIGATION V. CITIES SERVICE OIL CO. (USE OF GROUNDWATER FOR SECONDARY OIL RECOVERY).

570 P. 2d 49-51 (Okla. 1977).

Descriptors: \*Oklahoma, \*W resources development, \*Groundwater resources, \*Secondary Recovery(Oil), Oil, Water resources, Groundwater, Water utilization, Water supply, Oil pollution, Administrative agencies, Adjudication procedure, Administration, Floods, Permits, Water allocation(Policy), Water rights.

The plaintiff irrigation association sought judicial review of the Water Resources Board's decision to grant the defendant oil company a permit to use fresh ground water in a water flood system for the purpose of secondary oil recovery. The plaintiff argues that such a use of water was 'waste' under the state ground water law. The defendant alleged that use of groundwater for secondary oil recovery was a beneficial use and was not 'waste'. The lower court reversed the Board's decision, supporting plaintiff's contention. On appeal, the state supreme court held that the use of fresh ground water for secondary oil recovery is not, of itself, a 'waste' under the state ground water law. The court found that the Board had promulgated administrative rules that recognized such a beneficial use. Since the legislation did not express its disapproval of these rules, the court held that the legislative intent was not to consider such a use a 'waste'. The court cautioned that this ruling did not mean such a use might not constitute waste. Each case must be determined on its individual facts. (Beamer-Florida) W78-12592

#### BOZ-LEW BUILDERS V. SMITH (FARMERS' RIGHT TO PRESCRIPTIVE EASEMENT FOR IRRIGATION).

571 P. 2d 389-93 (Mont. 1977).

Descriptors: \*Montana, \*Prescriptive rights, \*Water rights, \*Irrigation, \*Irrigation ditches, Legal aspects, Irrigation practices, Irrigation water, Canals, Easements, Alternative costs,

Water policy, Flow, Damages, Ditches, Prescriptive rights, Equity.

The defendant farmers appealed from a judgment of the district court which imposed a continuing injunction prohibiting them from entering upon or interfering with the peaceable possession of the plaintiff apartment owner's property. The injunction was a result of the defendants attempt to exercise a prescriptive easement in a ditch which ran over plaintiff's property. Defendants had used this ditch for irrigation purposes since 1930. Although the ditch was open and visible, the plaintiff, after purchasing the property, acted on the advice of his attorney and filled in the ditch. The trial court in granting the injunction held that although the defendants owned a valid ditch right across plaintiff's property, the relief sought by the defendants would not result in a substantial benefit to them. The Supreme Court found that the defendants did suffer damages as a result of the plaintiff's invasion of their ditch easement. Consequently, the lower court's judgment was vacated. The Supreme Court, in balancing the equities, held that the plaintiff interfered with the defendants' right and the plaintiff must find an alternative way of getting water around his property. The court awarded damages equal to the cost of renting and operating the sprinkler system as well as attorney's fees to the defendants. (Beamer-Florida) W78-12593

#### DEPARTMENT OF NATURAL RESOURCES V. ADAMS (RIPARIAN LANDOWNER'S RIGHT TO BUILD DUCK BLIND).

377 A. 2d 500-08 (Md. Ct. Spec. App. 1977).

Descriptors: \*Maryland, \*Ducks(Wild), \*Riparian rights, \*Hunting, \*Sites, Bodies of water, Waterfowl, Wildlife, Riparian land, Riparian waters, Administrative agencies, Permits, Water law, Legal aspects, Watercourses(Legal aspects), Natural resources, Game birds, Wildlife management.

Plaintiff riparian landowner appealed an order of the Department of Natural Resources (DNR) which approved and confirmed the allocation of duck blinds along a statutory line separating two bays. Pursuant to a notification that his blind had been constructed too close to the site assigned to a third party, the plaintiff alleged that the defendant had assigned the blind site to the third party illegally. After reviewing the alleged illegal assignment, the defendant upheld the assignment to the third party. On appeal, the order of the defendant was reversed. In affirming the decision of the trial court, the appellate court found that the statute which created the statutory line for duck blind locations only authorized the defendant to issue site assignments to landowners whose lands were adjacent to the two bodies of waters mentioned in the statute. Since the third party was not a riparian landowner under this definition, the court found that the defendant erred in assigning him a duck blind location the statutory line. (Beamer-Florida) W78-12594

#### MYERS V. CAPLE (RIPARIAN LANDOWNER'S RIGHT TO RECLAIM LAND).

258 N.W. 301-06 (Iowa 1977).

Descriptors: \*Iowa, \*Levees, \*Remedies, \*Riparian rights, \*Alteration of flow, Flow, Rainfall, Administrative agencies, Flood damage, Damages, Flood data, Streams, Riparian lands, Legal aspects, Water rights, Drainage, Overflow, Floods.

Plaintiff landowners brought an action to enjoin the defendant landowner from completing a levee along the bank of a creek. The plaintiff also sought to have the defendant remove that part of the levee already constructed. The controversy arose when the defendant submitted plans to the Natural Resources Council for a levee to protect seventy acres of his land from flood damage. These plans

were approved by the Council over plaintiff's objection. Although the plaintiffs did not appeal the administrative order, they sought and were granted a permanent injunction by the lower court. The defendant appealed the trial court decision alleging that the plaintiffs had failed to exhaust their administrative remedies. The Supreme Court of Iowa held that the plaintiffs did not have to exhaust their administrative remedies because the Natural Resources Council did not have exclusive jurisdiction over drainage differences. However, in balancing the equities, the court found that the plaintiffs were not entitled to injunctive relief because they failed to provide convincing evidence that they would suffer substantial or irreparable harm. However, if the levee causes damage in the future, the plaintiffs will not be foreclosed from seeking damages or injunctive relief. (Beamer-Florida) W78-12595

#### RECREATIONAL TRESPASS ACT.

Mich. Comp Laws Ann sec 317.172 (1967), as amended, (Supp 1977).

Descriptors: \*Michigan, \*Farms, \*Public rights, \*Recreation, \*Trespass, Behavior, Fishing, Highways, Hunting, Land tenure, Law enforcement, Legal aspects, Legislation, Public access, Reasonable use, Safety, Trapping, Water law.

A person shall not enter in or remain upon the lands of others for the purpose of hunting; fishing in a private lake, pond or stream; or operating a snowmobile, off-road vehicle or other recreational vehicle without the written consent of the owner, his lessee or agent, if: (1) the lands are enclosed to exclude intruders, or (2) the lands are posted in a conspicuous manner. A fisherman wading in or floating upon a navigable, public stream of a length greater than 15 miles may, without written permission or verbal consent, enter upon the upland and walk a route as closely proximate to the clearly defined bank as possible when necessary to avoid an obstruction or hazard. No person shall discharge a firearm within the right of way of a public highway adjoining any platted property; fenced or posted land; or farm land without the written permission of the owner, his lessee, or agent, of the abutting land. A person also shall not, without due authority, erect posters or enclose lands so as to prohibit the public enjoyment of recreational activities on the lands. (Jordan-Florida) W78-12596

#### APPROPRIATION OF WATER.

S.D. Comp. Laws Ann. secs 46-5-1 thru 46-5-46 (1967).

Descriptors: \*South Dakota, \*Appropriation, \*Water rights, \*Water allocation(Policy), \*Water management(Applied), Water distribution(Applied), Legislation, State governments, Streams, Springs, Riparian rights, Non-navigable waters, Dam construction, Irrigation, Permits, Domestic water, Surface waters, Reclamation, Reclaimed water, Diversion, Municipal water, Water utilization, Water users, Surplus water.

In South Dakota, a landowner cannot impede the natural flow of a stream on his land. However, he may construct a dam across a non-navigable stream if the course of the water is not changed and vested rights are not interfered with. In addition, a landowner may appropriate water subject to the principle of beneficial use. Appropriation in excess of reasonable needs is not allowed. Specific limitations on the amounts that may be appropriated for the purpose of irrigation are set. Permits are required for appropriation except that a permit is not required for reasonable domestic use. Construction of works prior to obtaining a permit is a misdemeanor and penalties are set forth. Procedures that must be followed in the application for water rights are indicated. In addition,



tion, procedures for approval of plans for construction are provided in the act, as well as procedures pertaining to improper construction. The act also regulates changes of use or place of diversion by the appropriator of the water. Failure to use beneficially appropriated water results in a reversion to unappropriated public water. Finally, the act sets forth procedures for appropriation by the United States, state institutions, or municipalities. (Quarles-Florida)  
W78-12597

#### DAMS AND RESERVOIRS.

Mont. Rev. Code sec 89-701 (1947); secs 89-702, 89-702.1, as amended, (Supp. 1975).

Descriptors: \*Montana, \*Reservoir construction, \*Reservoir operation, \*Safety, Reservoirs, Reservoir design, Discharge(Water), Water storage, Impoundments, Surface waters, Storage, Structural stability, Dams, Dam design, Dam construction, Dikes, Flood control, Embankments, Impounded waters.

Any reservoir which is to be filled must be so thoroughly and substantially constructed so that it can safely hold any water that may be stored in it. Any person, association or corporation wishing to build a dam, dike, or reservoir must construct it in a thorough, secure and substantial manner. The department of natural resources may at any time examine any dam, dike or reservoir either on its own motion or upon complaint under oath made by three persons who feel their homes would be in danger in the event of a flood due to the breaking of a dam, dike, or reservoir. These persons must have reason to believe the structure is unsafe or is being overfilled. If the department finds the structure unsafe or overfull, it will notify the appropriate county attorney who will take the necessary steps to abate the danger and make the structure safe. If either party is dissatisfied with the department's findings, an appeal may be made to the appropriate district court but the department's judgment shall control until the court makes a final determination. The department's jurisdiction is limited to structures of the size defined in the statute. (Beamer-Florida)  
W78-12598

DELANO V. COLLINS (DAMAGES FROM ALTERING NATURAL DRAINAGE).  
364 N.E. 2d 716-21 (Ill. App. Ct. 1977).

Descriptors: \*Illinois, \*Real property, \*Reasonable use, \*Surface runoff, \*Land development, Alteration of flow, Drainage, Drainage systems, Boundary disputes, Land tenure, Land use, Storm water, Urban drainage, Urban runoff, Adjacent landowners, Storm runoff, Water law, Judicial decisions.

Plaintiffs sought to enjoin the defendant from altering the natural drainage of his property. Plaintiffs alleged that a house which defendant built caused an unusually large amount of water to flow onto plaintiff's residential lot during heavy rains. Plaintiffs also sought punitive damages for alleged willful and wanton acts in continuing to construct the improvements. The trial court granted summary judgment for defendant and the appellate court affirmed. The appellate court held that the plaintiffs had the burden of proving that the acts of defendants were beyond a range consistent with the policy of reasonable use. The court also held that defendant was not required to maintain his lot in an unimproved, unused state for the benefit of plaintiffs. Because the plaintiffs failed to establish that the defendant violated the policy of reasonable use in constructing improvements on the property, the alleged failure to plan for drainage problems did not warrant the award of punitive damages. The record shows that the defendant did not alter the elevation or otherwise infringe upon the boundaries of plaintiffs' parcels. (Jordan-Florida)  
W78-12599

GROUND WATER IN THE CALIFORNIA WATER QUANDRY,  
Environmental Defense Fund, Washington, DC.  
For primary bibliographic entry see Field 4B.  
W78-12615

THE ROLE OF 208 IN PLANNING GROUND-WATER USE,  
Southern California Association of Governments, Los Angeles.  
For primary bibliographic entry see Field 5G.  
W78-12616

THE INFLUENCE OF THE SAN FERNANDO CASE ON THE WORK OF THE GOVERNOR'S WATER RIGHTS COMMISSION,  
For primary bibliographic entry see Field 4B.  
W78-12617

POLICIES, ISSUES AND CONCERNS OF WATER AND RELATED LAND RESOURCES INTEREST GROUPS,  
Kansas Water Resources Board, Topeka.  
J. C. Gottschamer.  
Bulletin No. 23, 1978. 45 p, 1 photo.

Descriptors: \*Kansas, \*Water resources, \*Land resources, Organizations, Legislations, Water quality, Water utilization, Irrigation, Water conservation, Boats, Agriculture, Livestock, Local governments, Interest groups, Policies.

Groups and organizations known to have an interest in Kansas water activities were asked to submit a copy of their policies and resolutions regarding their position on various aspects of the state's water and related land resources. Comments of general or specific concern and suggestions for new or amendatory legislation also were encouraged and accepted. The policy and issues statements were organized into a 'Statement of Water and Related Land Resources Policies, Issues, and Concerns' for each of the respondent groups. A topical index also was included in the bulletin. (Froelich-ISWS)  
W78-12619

WATER RESOURCES AND HEALTH PROBLEMS IN DEVELOPING COUNTRIES (IN FRENCH),  
Paris-7 Univ. (France). Dept. of Parasitology.  
For primary bibliographic entry see Field 5F.  
W78-12625

SOCIAL IMPACT ASSESSMENT, 10.  
For primary bibliographic entry see Field 6B.  
W78-12652

THE FUTURE OF UNIVERSITY EDUCATIONAL PROGRAMS IN A 'STEADY-STATE' ENVIRONMENT,  
A. R. Chamberlain.  
Keynote address, UCOWR, July 28, 1975, Auburn, Alabama. Theme: The Challenge of Water Resources Education, 11 p.

Descriptors: \*Universities, \*Education, Water resources, Economics, Administration, Government, \*Steady-state society, Myths, \*Human capital, Energy independence, Freedom.

This keynote address first exposes the myth of a 'steady state' society. No growth or minimum-level growth is not possible because of the volatile nature of our economy and society. University enrollment is constantly changing in both age composition and subject interests; our monetary sector is in constant flux, showing inflation and recession at the same time; and our energy supplies and prices have switched from one resource area to another and from low to high costs. The author goes into depth concerning the steady-state situa-

tion of our universities and recalls that increased instability occurred in the late 1960's. Optimism rather than pessimism is warranted because of the deep-seated drive for education and learning in the U.S. There is not a surplus of teachers but only an unwillingness to permit these available teachers to fulfill useful functions. Government assistance to universities and the creation of a Water Education and Research Advisory Committee are twin modes for increasing interest and research in water resource education. (Coan-NC)  
W78-12653

THE DISTRIBUTIVE EFFECTS OF PUBLIC LAW 92-500,  
Northwest Missouri State Univ., Maryville, Dept. of Business and Economics.  
For primary bibliographic entry see Field 5G.  
W78-12655

TANKERS AND OIL TRANSFER OPERATIONS ON THE DELAWARE RIVER AND BAY.  
Comptroller General of the United States, Washington, DC.  
For primary bibliographic entry see Field 5G.  
W78-12656

PROCEEDING OF ENVIRONMENTAL IMPACT STATEMENT CONFERENCE, HELD AT KANSAS CITY, MISSOURI ON 8-9 NOVEMBER, 1972.  
Environmental Protection Agency, Kansas City, MO.  
For primary bibliographic entry see Field 6G.  
W78-12657

A ROLE FOR UCOWR IN MEETING NATIONAL NEEDS,  
Idaho Univ., Moscow. Idaho Water Resources Research Inst.  
J. S. Gladwell.  
Presented at 1975 annual meeting of Universities Council on Water Resources, Auburn University, Auburn, Alabama, July 27-30, 1975, Workshop No. IV, 9 p.

Descriptors: \*Water Resources Research Act, \*Water demand, Water resources, \*Planning, \*Legislation, Education, Water resources, Land use, Planning, Environment, Universities Council on Water Resources(UCOWR), \*National needs, National involvement.

This article describes how UCOWR might prepare itself so that it would be in a position to continually assess national water needs and have the mechanisms by which these needs can be addressed. Its primary effort should be to define major issues in water resource planning. Land use planning and energy resource planning are two major areas which UCOWR must explore and relate to water resource planning. Educational programs beyond the level of training grants, such as exchange programs, visiting scientist programs, and water resource fellowships, should be explored and instituted. UCOWR's position on a variety of water resources issues should be explicitly described so that it may become an authority on national water resource issues. (Coan-NC)  
W78-12659

OPTIONS FOR MONITORING LOCAL PERMITS IN THE NORTH CAROLINA COASTAL AREA.  
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.  
Occasional Papers Series, June 1978. 85 p, 3 append. Nessa, S.; French, S.; and Lowry, G.K., editors.

Descriptors: \*Coasts, \*Permits, \*Management, \*Coastal areas, Regulation, Evaluation, Local

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

governments, State jurisdiction, Land use, Planning, Decisionmaking, Methodology, Administration, Programs, \*Areas of Environmental Concern, \*North Carolina, Implementation, Procedural monitoring, Substantive monitoring, Cumulative Impact Assessment.

A series of options is described for monitoring the implementation of one element of North Carolina's Coastal Management Program. The system will monitor the issuance of minor permits in coastal areas of environmental concern (AECs). Monitoring is distinguished from evaluation, and is defined as being concerned with the conformance of program activities with program goals and guidelines. The management of AECs is the joint responsibility of local governments in the coastal zone and the State. The monitoring program performs three functions—Procedural Monitoring insures that permit issuance complies with procedural requirements developed by the State; Substantive Monitoring insures that permit issuance complies with use standards and regulations developed by the State; Cumulative Impact Assessment measures the impact of development against the legislatively mandated goals and objectives for the coast. Several options for achieving each of these monitoring functions are described. Each option differs in breadth and depth, in the types of analysis required, and the amount of effort needed to collect the monitoring data. The final monitoring system would incorporate options from each functional area. Any combination of options is possible. A system for evaluating and selecting the best combination of options is described. (Nessa-NC) W78-12662

**PLAN OF ACTION: THE TRINITY RIVER PUBLIC INVOLVEMENT PROGRAM,**  
Texas A and M Univ., College Station. Dept. of Urban and Regional Planning.  
For primary bibliographic entry see Field 6B.  
W78-12664

**WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT: WHAT ARE THE NATION'S WATER SUPPLY PROBLEMS AND ISSUES.**  
General Accounting Office, Washington, DC.  
For primary bibliographic entry see Field 6D.  
W78-12665

**FLOOD EMERGENCY BUILDING INSPECTOR PROGRAM FOR THE CITY OF WILKES-BARRE.**  
Wilkes-Barre Dept. of Planning and Development, PA. Bureau of Flood Recovery.  
For primary bibliographic entry see Field 6F.  
W78-12667

**WATER QUALITY PLANNING, AND OPPORTUNITY FOR CONSERVATION DISTRICT COMMISSIONERS,**  
Iowa Dept. of Soil Conservation, Des Moines. Conservancy District Div.  
For primary bibliographic entry see Field 5G.  
W78-12687

**DOING SOMETHING ABOUT OIL SPILLS,**  
For primary bibliographic entry see Field 5G.  
W78-12698

**MONTANA'S YELLOWSTONE RIVER: WHO GETS THE WATER,**  
H. Fischer.  
Sierra Club Bulletin, Vol. 63, No. 6, p 13-16, July-August, 1978.

Descriptors: \*Montana, \*Rivers, \*Wildlife conservation, \*Water allocation(Policy), Administrative agencies, Strip mines, Industries, Recreation, Water utilization, Competing uses, Regional development, Public benefits.

The destiny of nearly one third of Montana and much of northern Wyoming is in question as agricultural, industrial, municipal and environmental interests compete for unallocated water of the Yellowstone River. The outcome will determine the economic future of the area as well as the fate of the region's fish and wildlife. Under Montana law, all of Yellowstone River's remaining water will be allocated in 1978. Montana's Department of Fish and Game has requested the use of all the water not yet allocated. Ranchers and farmers have been the traditional users of Yellowstone River, but now others want the water. Stripmining began to boom in Montana in the late 1960's. With stripmining came mind-boggling energy development plans, and now industry factions are competing for the river's water. Montana law, however, gives priority to state agencies because they deal with public values such as wildlife conservation and clean water. At recent hearings, industries were not allowed to submit applications for the water. Who will ultimately get the water will be decided by the state's Board of Natural Resources. Montana now has the chance to limit industrial growth in deference to outstanding natural values. (Spiegel-Florida) W78-12699

**WATER QUALITY MISMANAGEMENT,**  
For primary bibliographic entry see Field 5G.  
W78-12700

**OIL AND GAS AND SULPHUR OPERATIONS IN THE OUTER CONTINENTAL SHELF.**  
Geological Survey, Washington, DC.  
For primary bibliographic entry see Field 6G.  
W78-12701

**HARMON COAL COMPANY V. DEPARTMENT OF ENVIRONMENTAL RESOURCES (REGULATION OF COAL STRIP MINE DRAINAGE OF ACIDIC WATER IN PENNSYLVANIA).**  
Pa. Cmwlth., 384 A. 2d 289-93 (1978).

Descriptors: \*Pennsylvania, \*Mine drainage, \*Strip mine wastes, \*Administrative decisions, Drainage water, Drainage effects, Alkalinity, Discharge(Water), Acidic water, Coal mine wastes, Strip mines, Acid mine water.

Plaintiff, a coal company, sought to review a state environmental hearing board order which affirmed the defendant Pennsylvania Department of Environmental Resources' (DER) denial of plaintiff's application for a mine drainage permit under the state's Clean Streams Act. Plaintiff leased several acres of land in a Pennsylvania township, which intervened as co-defendant. Plaintiff intended to operate a coal strip mine on the property, and applied for a mine drainage permit from defendant DER. Defendant DER denied the application, based on the low alkalinity and buffering capacity of the watershed. Defendant DER contention that this would make it difficult for any acid mine drainage or siltation from strip mining to be absorbed, resulting in a deleterious effect on the water supply. The Board affirmed defendant DER's denial and on appeal the Commonwealth Court of Pennsylvania affirmed. The court held the Board's findings that the overburden was acidic and that there would be a likelihood of acid mine drainage discharge were supported by substantial evidence. The court also held that the Board did not err in its determination that the DER's principal witness was qualified to give opinion evidence. (Quarles-Florida) W78-12713

**COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, AND TEXAS. VOLUME 7, APPENDIX XIV: STATE WATER LAWS, POLICIES AND PROGRAMS.**  
For primary bibliographic entry see Field 6B.

W78-12767

**BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY. VOL. V, AN. H: HYDROELECTRIC POWER: AN. I: ROLE OF THE STATE OF MISSISSIPPI IN THE PLANNING & DEVELOPMENT OF THE WATER AND RELATED LAND RESOURCES: AN. J: TRANSCRIPTS OF PUBLIC HEARINGS.**  
For primary bibliographic entry see Field 6B.  
W78-12772

**KING RESOURCES COMPANY V. BOARD OF ENVIRONMENTAL PROTECTION (PROCEDURE FOR CONSTRUCTION CERTIFICATION UNDER THE FEDERAL WATER QUALITY CONTROL ACT AFFIRMED).**  
383 A. 2d 383-87 (Me. 1978).

Descriptors: \*Maine, \*Water quality control, \*Water quality act, \*Concrete construction, Construction, Piers, Permits, Navigable waters, State governments, Steel structures, Water quality standards, Water quality.

Plaintiff, owner and operator of oil terminal facility, appealed from a decision by the defendant Maine Board of Environmental Protection (Board), denying its certification that the proposed construction of a new pier would not violate applicable water quality standards. Plaintiff sought a permit from the U.S. Army Corps of Engineers to construct a new steel and concrete pier at plaintiff's oil terminal facility. Under the Federal Water Quality Control Act, plaintiff was required to obtain certification from the defendant Board that such activity would be conducted in a manner that reasonably assures no violations of applicable water quality standards. After denial of certification, plaintiff appealed. The case was remanded to the Board for further proceedings. Plaintiff contended here that certification should have been granted by the lower court, or alternatively, that on remand the Board should be limited to the pre-existing record. Defendant Board insisted that plaintiff lacked standing. The Maine Supreme Judicial Court held that plaintiff had standing to request certification under the Federal Water Quality Control Act. The court further held that the lower court acted properly in remanding the case because the record needed further development before disposal. (Quarles-Florida) W78-12777

**FLOOD PLAIN ZONING.**  
For primary bibliographic entry see Field 6F.  
W78-12778

**WATER MANAGEMENT DISTRICTS.**  
For primary bibliographic entry see Field 4A.  
W78-12780

**MANAGEMENT AND STORAGE OF SURFACE WATERS.**  
Saint Johns River Water Management District, Palatka, FL.  
Fla. Admin. Code, Ch 161-4, secs 4.01 thru 4.47 (1978). 1 app.

Descriptors: \*Florida, \*Permits, \*Water districts, \*Water management(Appplied), State governments, Administration, Regulation, Water quality control, Engineering structures, Dams, Construction, Surface waters.

The purpose of the rules described herein is to implement Florida's water policy concerning management and storage of surface waters in the St. Johns River Water Management District. Rules apply to those who wish to alter, construct, operate, or abandon a dam, impoundment, reservoir, or any similar work in the district. Generally, a permit is necessary before work may begin. The

permitted activity must among other things: be reasonable and beneficial; not interfere with any existing legal water use; not restrict or alter the rate of flow of a stream or watercourse by more than 10 percent at any time or any withdrawal point; not significantly increase or decrease groundwater or lake levels within the District. Regulations concerning permit applications and requirements are detailed, as are grounds for which exemptions may be granted. The granting of a permit does not give inalienable rights to the permittee. This type of licensing may be modified or revoked in certain instances. Permission to begin construction may be given before a permit has been issued when an emergency situation demands immediate action. A sample permit application is included. The District is obligated to inspect surface water works periodically to determine whether all rules and regulations are being obeyed. (Spiegel-Florida)  
W78-12812

#### WORKS OF THE ST. JOHN'S RIVER WATER MANAGEMENT DISTRICT.

Saint Johns River Water Management District, Palatka, FL.  
Fla. Admin. Code, Ch 1-6, secs 6.01 thru 6.49 (1978). 1 app.

Descriptors: \*Florida, \*Water districts, \*Regulation, \*Water management(Applied), State governments, Estuaries, Floodways, Canals, Administration, Permits, Administrative agencies.

The purpose of the rules described herein is to implement the declared water policy of the state of Florida and the St. Johns River Water Management District in relation to Works of the District. The rules pertain to the: St. Johns River; St. Johns Marsh; Oklawaha River; St. Mary's River; Nassau River; Intracoastal Waterway; and all the natural floodways, tributaries, canals, estuaries and channels in the respective districts. Anyone desiring to connect to, withdraw water from discharge water into, or otherwise use these waterways must abide by these regulations. Unless expressly exempted, a permit is required by anyone wishing to use the waterways in any of the aforementioned manners. Procedures for obtaining a permit are detailed, as are specific exemptions to the permit requirement. Conditions for issuance, revocation, and modification of permits are dealt with. Emergency and remedial measures are described, and a sample permit application is included. Periodic inspections by the Board are permitted to ensure compliance with the regulations. In the event the Board official or representative should determine on any such inspection that remedial measures are required, the procedure and requirements for an order requiring the remedial work are delineated. (Spiegel-Florida)  
W78-12813

#### WORKS OF THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT.

Southwest Florida Water Management District, Brooksville.  
Fla. Admin. Code, CH 16 J-1, secs .001 thru 1.41 (1978).

Descriptors: \*Florida, \*Water management(Applied), \*Administration, \*Watershed management, Permits, Regulation, Water conservation, Water supply development, Storm runoff, Surface runoff, Water districts.

In these official 'Works' rules of the Southwest Florida Management District, 'Works' are herein defined as any lake or other impoundment, stream or other watercourse, control structure or other facility owned and maintained by the District. The District's responsibility is to protect existing and future works from actions which would impair their capacity to accomplish intended purposes. A permit is required to connect to, withdraw water from, discharge water into, place construction

within or across, or otherwise make use of a work. Certain activities are excepted from regulation such as removal of a dock or pier, and construction or removal of a pump for individual domestic use (as long as the bank is not altered). To obtain a permit, the activity must be reasonable, beneficial and must not be inconsistent with the public interest. Permits will be denied for several types of activities: those that (1) will cause serious adverse effects on lands not controlled by the applicant; (2) will increase or decrease a watercourse's rate of flow by five percent or more; or (3) will increase peak rate of flow or total volume of storm runoff by 10 percent or more. (Stump-Florida)  
W78-12814

#### RULES OF THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT.

Southwest Florida Water Management District, Brooksville.  
Fla. Admin. Code, Ch 16 J-0, secs .001 thru .40 (1978).

Descriptors: \*Florida, \*Water management(Applied), \*Administration, \*Watershed management, Permits, Regulation, Water conservation, Water supply developments, Water permits, Water districts, Water control.

The Southwest Florida Water Management District (SFWMD) has responsibility for planning, constructing, and operating necessary water management works in the Peace River Basin and for the Four River Basins Florida project (in cooperation with the federal government). It also controls the Green Swamp Watershed basin. All other watershed basins are controlled by local basin Water Management boards. This section of the SFWMD Rules contains explicit boundaries for each water basin within the SFWMD. Permits are required for any consumptive use of water, for construction of a well and for other activities relating to management and storage of surface waters. Permit applications are required to include drawings of a location plan showing points of installation, construction, withdrawal, discharge or use, and also designated elevations such as canal bottom elevations, water surface elevation and ground elevation. All permits are issued contingent upon continued ownership or other control of property rights in underlying, overlying or adjacent lands. The SFWMD must also establish minimum rates of flows and regulatory levels using the best information and methodology available to protect existing as well as future consumptive uses of water. (Stump-Florida)  
W78-12817

#### CONSUMPTIVE USE OF WATER.

Southwest Florida Water Management District, Brooksville.  
Fla. Admin. Code, Ch 16J-2, secs 2.01 thru 2.24 (1978).

Descriptors: \*Water management(Applied), \*Florida, \*Consumptive use, \*Watershed management, Water requirements, Withdrawal, Regulation, Riparian rights, Public rights, Well regulations, Water permits, Land development.

The Consumptive Use of Water Rules of the Southwest Florida Water Management District require permits if: (1) the withdrawal exceeds 1 million gallons of water in one day, or the average annual daily withdrawal will exceed 100,000 gallons; (2) the withdrawal is from a well with an inside diameter of more than six inches. No permit is required for domestic consumption of water by individual users. Permit applications must include the maximum amount of water to be withdrawn, the maximum amount to be consumptively used per year and on any single day, the source of the water supply, the use to be made of the water, and the place where the water is to be used. The applicant must include names and addresses of all persons whose property lies within designated

distances from the point of withdrawal. A notice of the application is to be provided once a week for two consecutive weeks in a general circulation newspaper. Copies of the notice must be mailed to applicable neighboring property owners. Objections to the application may be received for 14 days after the first publication of notice, and a public hearing shall be held no sooner than seven days after that. (Stump-Florida)  
W78-12822

#### SOUTH FLORIDA WATER MANAGEMENT DISTRICT V. RATNER (WATER MANAGEMENT DISTRICT WITH EASEMENT OVER PRIVATE PROPERTY MUST PROVIDE ACCESS ROUTES FOR LANDOWNERS).

357 So. 2d 1055-60 (3d D.C.A. Fl. 1978).

Descriptors: \*Florida, \*Access routes, \*Projects, \*Easements, Water management(Applied), Flood control, Levees, Canals, Land, Construction, Bridges, Legal aspects.

A private landowner brought this suit against the South Florida flood control district. Plaintiff sought to gain access to his land which was surrounded by levees and canals constructed by the defendant pursuant to an easement agreement entered into with plaintiff's predecessor. A lower court held that defendant must provide said access. The easement agreement which defendant and plaintiff's predecessors in title entered into gave the defendant the right to construct, operate and maintain a project for flood control, reclamation and conservation on the land. However, the grantors retained substantial rights in the property, surrounding plaintiff's land—defendant erected locked gates across the only access routes. Plaintiff was denied a key to the gates. On appeal, the Third District Court of Appeal held that the trial court was correct in its holding that plaintiff had a right to reasonable access and that the defendant was obligated to provide such access. However, the court reversed and remanded that portion of the decision which required the defendant to provide a bridge for the plaintiff. (Quarles-Florida)  
W78-12825

#### PUBLIC DRINKING WATER SYSTEMS UNDER THE FLORIDA SAFE DRINKING WATER ACT.

For primary bibliographic entry see Field 5G.  
W78-12836

#### POLLUTION OF WATERS.

Florida State Dept. of Environmental Regulation, Tallahassee.  
Fla. Admin. Code, Ch 17-3, secs 3.01 thru 3.21 (1978). 1 app.

Descriptors: \*Florida, \*Water districts, \*Well regulations, \*Water users, Water quality control, Water quality standards, Water supply, Drainage wells, Effluents, Water management(Applied), Water permits, Water pollution control.

In order to protect state waters, the Florida Pollution Control Board (Board), under rules promulgated by the state Department of Environmental Regulation (DER), declares that the presence of pollutants in excess of certain concentrations is deemed to be prima facie evidence of pollution and is expressly prohibited. Where a new or increased source of pollution threatens degradation of existing water quality, such project development will be denied a DER permit until the Board is satisfied that such development is in the best interests of the state. The best practical treatment available under existing technology is required as a part of the initial project design. The Board will attempt to cooperate with the federal government on all matters affecting federal interests. Waters uses for navigation, utility and industrial purposes, known as Class V waters, are to be reviewed periodically with the goal of water quality enhancement and subsequent reclassification. The



## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

criteria for the five different water classifications are set forth, as well as minimum conditions of all waters. The permit procedure for drainage wells is included, as are domestic and industrial waste treatment requirements. (Quarles-Florida) W78-12837

#### SOVEREIGNTY SUBMERGED LANDS.

Florida Dept. of Natural Resources, Tallahassee. Fla. Admin. Code, Ch 16C-12, secs 12.01 thru 12.04 (1978).

Descriptors: \*Florida, \*Land management, \*Riparian land, \*Regulation, Natural resources, Submergence, Islands, Administrative agencies, Sandbars, Navigable waters, Landfills, Land use.

These Florida Department of Natural Resources rules govern the purchase and sale of sovereignty submerged lands. These lands are defined to include tidal lands, islands, sandbars, shallow banks, and lands under navigable waters to which the state acquired title by virtue of statehood in 1845. Application to the Board of Trustees of the Internal Improvement Trust Fund (Board) to purchase lands riparian to uplands may be made by the riparian owners only. An applicant must include, among other items, a survey of the area showing boundary lines of the parcel sought and of the applicants' adjacent uplands, the existing mean high water line, evidence of title in the adjacent uplands, and a statement of proposed use. When state-owned submerged lands have been filled without authority, the Board may: (1) direct the fill be removed at the applicant's expense; (2) direct the fill remain as state-owned and have it surveyed at the applicant's expense; or (3) sell the filled lands. If sold, full payment is due within 90 days after notification of confirmation of the sale by the Board. Applications to purchase land not riparian to uplands must include similar information. (Quarles-Florida) W78-12838

#### PERMITTING OF ARTIFICIAL RECHARGE SYSTEMS.

Florida Dept. of Natural Resources, Suwannee River Water Management District, White Springs, FL. Fla. Admin. Code, Ch. 16 H5, secs 5.01 thru 5.31 (1978).

Descriptors: \*Florida, \*Water management(Applied), \*Water districts, \*Regulation, Permits, Administration, Well casings, Well regulations, Discharge(Water), Water wells, Artificial recharge, Administrative agencies.

The rules and regulations described herein are designed to regulate artificial recharge systems within the Suwannee River Water Management District. Artificial recharge, as used here, is defined as the intentional introduction of water into any underground formation. Included in the definition are fluids discharged from land application facilities, and disposal, storage, and connection well facilities. Excluded are wastewaters from residential septic tank systems, effluent from certain sewage treatment plants, and facilities for agricultural irrigation. In most instances, work may not commence on an artificial recharge system without a permit. Certain wells, however, are exempt from the permit requirement. Rules detailing how to file a permit application and under what conditions construction may be exempted are stated. The District may require public hearings before a permit is issued; it is also entitled to give orders relating to drilling techniques designed to prevent waste and pollution. In addition to the permit requirement, a specific casing and sealing program shall be submitted to the District for approval. Details in regard to this program are set out. Periodic well testing is required, as are written records of all construction work performed. (Spiegel-Florida) W78-12839

#### RULES OF THE WEST COAST REGIONAL WATER AUTHORITY.

West Coast Regional Water Authority, Clearwater, FL. Fla. Admin. Code, Ch 16 M-1, secs 1.01 thru 1.06 (1978).

Descriptors: \*Florida, \*Local governments, \*Regulations, \*Water supply development, Legislation, Water supply, Environmental effects, Urbanization, Governmental interrelations, Water resources development, Comprehensive planning.

Florida statutes, chapter 74-114, authorizes municipalities and counties to create water supply authorities for the purpose of assisting local governments in meeting the water supply needs of rapidly urbanizing areas. Due to this act, Hillsborough, Pasco, and Pinellas counties, along with S. Petersburg and Tampa, created the West Coast Regional Water Supply Authority (Authority). The specific description of the organization is set forth herein. Rules governing the number of members and length of appointments are included, as are Authority boundary limitations. All regulations concerning the acquisition of required water for use by Authority members are published in such a manner as will give priority to reducing adverse environmental effects of excessive or improper withdrawals of water from concentrated areas. Procedures to be followed when contracting for professional services are set out. Included are qualifying terms and performance data which firms must submit. The Authority is required to publicly announce when professional services are required, except in cases of valid emergencies. This regulation of public announcement insures competitiveness. All Authority proceedings shall be open to the public and conducted in accord with the promulgated rules. (Spiegel-Florida) W78-12859

#### SIERRA CLUB V. BERGLAND (FEDERAL AGENCY FINDING OF SUDDEN IMPAIRMENT OF WATERSHED CHANNEL REVERSED).

451 F. Supp. 120-31 (N.D. Miss. 1978).

Descriptors: \*Mississippi, \*Channel improvement, \*Watersheds(Basins), \*Administrative decisions, Federal government, Watershed management, Permits, Judicial review, Floods, Administrative agencies, Environmental effects, Flood control.

Plaintiff Sierra Club brought this action against various federal agency administrators, as well as several county agencies of Mississippi, seeking injunctive relief to halt proposed channel improvement of a section of the Tippah River watershed. The proposed project, a joint venture by the U.S. Army Corps of Engineers and the federal Soil Conservation Service (SCS), called for the removal of silt deposits from the river. The project involved both government and privately owned land along the channel. The work on the federal land involved was authorized by Congressional legislation. Defendants contended that the work on the private property was authorized as ameliorating an impairment of the watershed, thus justifying emergency relief under the Flood Control Act (FCA). A permit was issued to defendants who did not prepare an environmental impact statement. The federal district court held that the administrative SCS decisions granting the project permit were subject to judicial review. On reviewing the evidence, the court held that there was no sudden impairment within the meaning of the FCA and that the SCS abused its discretion. An environmental impact statement is required in this instance and the injunction halting the channel improvements was issued. (Quarles-Florida) W78-12862

#### ELWOOD V. CITY OF NEW YORK (LIABILITY FOUND FOR POLLUTION DAMAGES TO PRO-

#### PERTY CAUSED BY DIVERSION OF HEADWATERS OF DELAWARE RIVER).

450 F. Supp. 846 76 (S.D.N.Y. 1978).

Descriptors: \*New York, \*Pennsylvania, \*Delaware River, \*Thermal pollution, Riparian land, Thermal pollution, Headwaters, Water supply, River flow, Damages, Riparian water loss, Diversion.

Consolidated actions were brought by riparian landowners who claimed the value of their land, located in Pennsylvania along the Delaware River, was diminished by defendant New York City's activities. Defendant diverted the river's headwaters for its public water supply, thereby causing thermal pollution of the river. Defendant built several reservoirs upstream of plaintiffs' lands and diverted large amounts of water from the Delaware River and its tributaries to fill these reservoirs. After the water was used by the general public in the area, it was discharged into drainage basins other than that of the Delaware River. In a complex opinion, the U.S. District Court discussed prior proceedings affecting the Delaware River, the Delaware River Compact and New York's Environmental Conservation Law, and the river's apportionment. The court then held that defendant was liable for damages caused by its activities and plaintiffs are allowed recovery based on a permanent trespass theory. Damages were to be determined by computing the difference between the present value of the land and what the value would have been but for the trespass. (Quarles-Florida) W78-12871

#### REGULATION OF WELLS.

Northwest Florida Water Management District, Tallahassee. Fla. Admin. Code, Ch 16G-3, secs 3.01 thru 3.32 (1978). 1 tab.

Descriptors: \*Florida, \*Water wells, \*Well regulations, \*Administrative agencies, Well data, Drilling, Comprehensive planning, Logging(Recording), Well permits, Water management(Applied), Water supply development.

The Northwest Florida Water Management District is entrusted with certain responsibilities, including: the development of a district water use plan; establishment of minimum surface water levels; operation and maintenance of district works; permitting construction involving underground formations; and general management of water within the District. The purpose of the rules stated herein is to implement these responsibilities. Extensive knowledge of the region's geology and hydrology was necessary for this implementation. This information was derived from sampling and testing wells. The District must be apprised of proposed well so that an evaluation may be made as to whether geologic and hydrologic data should be compiled from a particular well. This data tells well designers and drillers valuable information relative to ground water production. These rules also delineate a permit system for construction, repair, and abandonment of wells. Permits, exemptions, fees, and revocation requirements are specified. Rules establishing minimum water well construction standards designed to protect ground water resources are also detailed. Finally, provisions for the enforcement of rules and penalties for non-compliance are set forth. (Spiegel-Florida) W78-12872

#### REGULATION OF WELLS.

Saint Johns River Water Management District, Palatka, FL. Fla. Admin. Code, Ch 16I-3, secs 3.01 thru 3.80 (1978). 1 tab, 1 app.

Descriptors: \*Water wells, \*Florida, \*Water management(Applied), \*Well regulations, Well data, Drilling, Legislation, Potable water, Water

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supply development, Well permits, Administration.

The rules described herein have promulgated to further the goals of the Saint Johns River Water Management District. These goals include, among others, permitting construction involving underground formations, developing a District water use plan, and general management of water within the District. These regulations pertain to public drinking water supply system wells only. The rules primarily relate to a system of permitting the construction, repair, and abandonment of wells. Included are rules concerning permits, exemptions, and fees. There is also a requirement regarding permit rejection. In instances such as these, a person receiving a permit rejection notice may request a hearing. Minimum standards for well construction are described. Included in this section is a table detailing dimensions and weights required for well casings. There are granting, sealing, and plugging regulations. The District may inspect during all stages of construction, repair, or abandonment to insure conformity with applicable standards. Finally, there are provisions for the enforcement of rules and penalties for non-compliance. (Spiegel-Florida)

W78-12873

**ALTERNATIVE POLLUTION CONTROL STRATEGIES; EQUITY, EFFICIENCY AND INFORMATION REQUIREMENTS.**  
Tennessee Univ., Knoxville. Dept. of Economics.  
For primary bibliographic entry see Field 5G.

W78-12875

#### REGULATION OF WELLS.

Southwest Florida Water Management District, Brooksville.  
Fla. Admin. Code, Ch 16J-3, secs 3.01 thru 3.30 (1978).

**Descriptors:** \*Florida, \*Water districts, \*Well permits, \*Well regulations, Drilling, Wells, Test wells, Drill holes, Water management(Applied), Water conservation, Water supply development, Adoption of practices.

This section of the Rules of the Southwest Florida Water Management District pertains to the regulation of wells. It codifies similar rules of the Florida Administrative Code, and is intended to enforce regulations promulgated by the state Department of Natural Resources regarding construction standards. The Rules require that drillers and contractors be registered, and provides an examination and registration procedure. Drillers are also required to post a \$5,000 bond for protection of the District's water resources. Several grounds are listed on which the Governing Board (Board) may refuse to issue or revoke a registration. The Rules also regulate actual construction of wells, prohibiting the wasted escape of any water. A permit must be obtained from the Board before any well or test hole may be constructed, and permits are to be valid for six months unless an extension is granted. If the Board rejects a permit application, it must issue a statement of the grounds for rejection. An appeals procedure is provided. The Rules also authorize the Board to declare "Water use-caution" areas where area-wide regulation is needed to forestall depletion of the District's water resources. (Stump-Florida)

W78-12878

#### REHABILITATION OF DEGRADED ARID LANDS.

United Nations, New York. Environment Programme; and Secretariat for International Ecology (Sweden).  
H. N. Le Houerou.  
Ecologica Bulletin, Vol 24, p 189-204, 1976. 4 tab, 20 ref.

**Descriptors:** \*Land reclamation, \*Arid lands, Impaired water use, Land development, Land use, Psychological aspects, Water resources planning, Social adjustment, Economic feasibility, Political aspects, Land conservation, Water conservation, Migration.

Desertization, aggravated by climatic circumstances, is primarily man-induced and any attempt at restoration must therefore interfere with human behavior. Cures of desertization as reviewed by this author consist of biological recovery or revival techniques which reverse the destructive processes. Natural, semi natural and artificial recovery techniques are reviewed and discussed although this analysis stresses the importance of social, political and economic reform. Among these reforms are population control, enforced emigration, transfer to other areas or activities, education, and control of land and water use. (Ticken-Arizona)

W78-12916

#### PERMITTING USES OF WATER.

South Florida Water Management District, Palm Beach.  
Fla. Admin. Code, Ch 16 K-2, secs 2.01 thru 2.16 (1978).

**Descriptors:** \*Florida, \*Permits, \*Administrative agencies, \*Water policy, Artificial recharge, Water management(Applied), Water shortage, Drilling, Water districts, Groundwater, Surface waters.

The rules described herein provide for the implementation of a permit system designed to regulate and control the use of ground and surface water within the South Florida Water Management District. Permits are required before construction may begin on any project involving artificial recharge (the intentional introduction of water into any underground formation). It is also necessary to acquire a permit for any use, diversion or withdrawal of water from the district which exceeds 100,000 gallons per day. Persons using water in conjunction with oil well drilling projects in Lee, Collier, or Hendry counties must have a general permit issued for the work. Regulations relating to the application for, and the modification and revocation of, these permits are included. In certain emergency situations, permission to begin use, withdrawal, or diversion may be given before a permit has been issued. The District may declare the existence of a water shortage when insufficient water is available to meet the requirements of the permit system. When this occurs, other regulations may be imposed on those seeking water permits. (Spiegel-Florida)

W78-12917

#### PERMITTING USES OF WATER.

Saint Johns River Water Management District, Palatka, FL.  
Fla. Admin. Code, Ch 16I-2, secs 2.01 thru 2.54 (1978).

**Descriptors:** \*Florida, \*Water supply, \*Water management, \*Water districts, Groundwater resources, Surface waters, Administrative agencies, Permits, Domestic water, Water shortage, Water resources development, Planning.

The St. Johns River Water Management District has enacted certain regulations to provide for the implementation of a permit system designed to regulate and control ground and surface waters in the District. The regulations shall be implemented only in those areas to be transferred to the District from the Central and Southern Florida Flood Control District. Permits are required for any use, diversion, or withdrawal of water which meets any of the criteria described in the rules. Reasonable conditions may be imposed on the permits when necessary for the conservation, protection, and control of District waters. Exempted from these

permit requirements are individuals who intend to use the water for only their own domestic use. Permit fee requirements are explained. Fees increase in direct relation to the average annual daily withdrawal of water requested. Permits may be modified or transferred in certain instances. The District Executive Director may, at his discretion, grant emergency authorization to begin use. The Board may also declare a water shortage to exist when there is sufficient water available to meet the requirements of the permit system. Procedures to be followed during a water shortage are listed. (Spiegel-Florida)

W78-12918

#### MANAGEMENT AND STORAGE OF SURFACE WATERS.

South Florida Water Management District, Palm Beach.  
Fla. Admin. Code, Ch 16 K-4, secs 4.01 thru 4.38 (1978).

**Descriptors:** \*Florida, \*Water districts, \*Surface waters, \*Water quality control, State governments, Administration, Engineering structures, Dams, Construction, Permits, Regulation, Water management(Applied).

The purpose of the rules described herein is to implement Florida's water policy concerning management and storage of surface waters in the South Florida Water Management District. Rules apply to those who wish to alter, construct, operate or abandon a dam, impoundment, reservoir or any similar work in the district. Generally, a permit is necessary before work may begin. Regulations concerning permit applications and requirements are detailed, as are grounds for which exemptions may be granted. The permittee shall include in the project design all proposed or required techniques for storm water runoff quality control. Submission of water quality data for the water discharged from the permittee's property may later be required. The granting of a permit does not give inalienable rights to the person holding the permit. This type of licensing may be modified or revoked in certain instances. Permission to begin construction may be given before a permit has been issued when an emergency situation demands immediate action. The District is obligated to inspect surface water works periodically to determine whether all rules and regulations are being obeyed. (Spiegel-Florida)

W78-12919

#### THE ARIZONA WATER COMMISSION'S CENTRAL ARIZONA PROJECT WATER ALLOCATION MODEL SYSTEM.

Arizona Water Commission, Phoenix.  
P. C. Briggs.

Hydrology and Water Resources in Arizona and the Southwest, Vol. 7, 1977, p 29-31.

**Descriptors:** \*Water management(Applied), \*Water allocation(Policy), \*Computer models, Model studies, Statistical models, Linear programming, Administration, Central Arizona Project, Arizona.

The purpose and operation of the Central Arizona Project water allocation model system are described, based on a system analysis approach developed over the past 30 years into an interdisciplinary science for the study and resolution of complex technical management problems. The system utilizes mathematical and other simulation models designed for computer operations to effectively solve such problems as the CAP faces including those concerned with social and economic considerations. The model is composed of two major components: (1) a linear program designed to determine the optimal allocation of all sources of water to all demands and, (2) a hydrologic simulator capable of reflecting the impact of distribution alternatives on per-unit cost of delivery. The model, currently being used, has substantially con-

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

tributed to a greater understanding of water usage potential in Arizona. (Tickes-Arizona)  
W78-12924

**MANAGEMENT AND STORAGE OF SURFACE WATERS.**  
Southwest Florida Water Management District, Brooksville.  
Fla. Admin. Code, Ch 16J-4, secs 4.01 thru 4.17 (1978).

Descriptors: \*Florida, \*Permits, \*Surface waters, \*Regulation, Dam construction, Engineering structures, Water storage, Engineering, Management, Project planning, Reservoirs, Construction.

The purpose of the rules described herein is to implement the water policy of the Southwest Florida Water Management District and the state of Florida concerning the storage and management of surface waters. Permits are necessary in many cases in order to construct, alter, abandon, or otherwise change any dam, reservoir, or appurtenant structure in Florida. Exemptions from this requirement may be given in some instances. Natural persons may be granted exemptions when attempting to capture and use the water for lawful purposes. In order to receive a permit, an application containing pertinent information must be filed. Permits may be denied if the proposed activity will adversely affect surface waters, or they may be granted conditionally. To receive a permit, one must pay processing fees and obtain an identification tag which must be displayed at the permitted facility. After a permit is issued, a public hearing may be called at which objections to the proposed project can be heard. Permits can be revoked or modified. Authorization for construction can be given without a permit in emergency situations. (Spiegel-Florida)  
W78-12926

**WATER RESOURCE PROBLEMS MERGE WITH ENERGY, LAND-USE POLICIES ON GLOBAL SCALE.**  
National Society of Professional Engineers, Washington, DC.  
J. T. Kane.  
Professional Engineer, Vol. 47, No. 10, p 16-18, October 1977, 3 pic.

Descriptors: \*Water policy, \*Administrative decisions, Water resources development, Planning, Political constraints, Administrative agencies, Comprehensive planning, Water law, Project planning, Water allocation (Policy), Water management (Applied), Constitutional constraints, State governments, Local governments, Federal government.

A review is presented of present and future worldwide water resource problems and the critical need for proper land use policies in solving the dilemma. Emerging from the U.N. Conference on desertification (1977) is the fact that 14 million acres of arable land per year are turning into deserts; however, national, state, and local organizations are becoming increasingly at odds between production and conservation points of view with respect to water resources. National legislation, such as the 1972 Water Pollution Control Act, the National Energy Act, and the establishment of the U.S. Water Resources Council are reviewed and the widespread lack of enthusiasm for the Carter administration's national water policy approach is documented. (Tickes-Arizona)  
W78-12928

**CAN DESERTIZATION BE STOPPED. SUMMARY AND RECOMMENDATIONS.**  
United Nations, New York. Environment Programme, and Secretariat for International Ecology (Sweden).  
H. N. T. Houerou, and A. Rapp.  
Ecologica Bulletin, Vol. 24, p 237-241, 1976, 11 ref.

Descriptors: \*Desertification, \*Arid lands, \*Deserts, Human population, Animal populations, Population, Distribution patterns, Density, Environmental effects, Water resources, Planning, Droughts, Range management, Economic feasibility, Political constraints, Area redevelopment, Water resources development.

Halting desertization in arid regions where population pressure is high is primarily a problem of reducing exploitation either through out-migration or family planning. Arid and semi-arid regions are well adapted for use by man only if it is possible to give support to beast and man in these areas during critical times. These authors review priority measures needed in formulating long term efforts to combat desertization, including (1) planning with a view of minimizing future drought hazards, (2) grazing as a major form of land use, (3) avoiding expensive methods, and (4) encouraging complementary activities for decreasing the pressure on grazing lands. Emphasized in this analysis is the critical need for a strong political organization with the power to implement necessary measures. (Tickes-Arizona)  
W78-12937

**REVIEW OF CANADIAN MUNICIPAL URBAN DRAINAGE POLICIES AND PRACTICES.**  
Gore and Storrie Ltd., Toronto (Ontario).  
For primary bibliographic entry see Field 5G.  
W78-12949

### 6F. Nonstructural Alternatives

**RELIABILITY OF FLOOD WARNING.**  
Illinois Univ. at Urbana-Champaign. Dept. of Civil and Ceramic Engineering.  
B. C. Yen, and W. H. Tang.  
In: Stochastic Processes in Water Resources Engineering, Proceedings, 2nd Intern. IAHR Symp. on Stochastic Hydraulics, Lund Institute of Technology, Sweden, August 1976. Lars Gottschalk, et al. (Eds.), Water Resources Publications, Fort Collins, Colorado, 1977, p 333-347 (Chapter 15). 2 fig, 11 ref.

Descriptors: \*Reliability, \*Hydraulics, \*Flood flow, \*River flood warning, \*Probability theory, \*Uncertainties, Flood stages, Flood routing, Upstream, Flood discharge, Prediction, Channels, Morphology, Simulation analysis, Mathematical models, Equations, Systems analysis, Forecasting, Hydrometeorologic factors, Multiplicative model, Physiographic factors.

Flood warning differs from flood forecasting in that for the former, the flood is actually occurring and the warning consists of prediction of the flood stage or discharge based on the flood information upstream; however for the latter, the prediction is made using estimated or measured hydrometeorological information such as rainfall, snowmelt, soil moisture conditions, and so forth. Usually, forecasting is made at a longer time in advance and is much less reliable than warning. Many hydraulic and hydrologic methods have been developed to route floods for flood warning. Unfortunately, none of the existing flood routing methods is exact, and consequently their accuracy is questioned. Moreover, uncertainties exist in many other aspects, including reliability of the hydrometeorologic and river morphologic input data used in the flood routing. Herein, a method based on probability theory is presented to demonstrate how the uncertainties involved in flood warning can be accounted for and how the probability of exceeding a flood stage can be assessed. The method adopts a first order, second moment analysis of uncertainties together with a multiplicative corrective model and is rather flexible in applications. (Bell-Cornell)  
W78-12528

**ALLOCATION OF WATER STORED FOR FLOOD CONTROL AND NAVIGATION PURPOSES (PROPOSED RULE).**  
Corps of Engineers, Washington, DC.  
For primary bibliographic entry see Field 6E.  
W78-12561

**THE INFLUENCE OF THE SAN FERNANDO CASE ON THE WORK OF THE GOVERNOR'S WATER RIGHTS COMMISSION.**  
For primary bibliographic entry see Field 4B.  
W78-12617

**FLOOD PLAIN INFORMATION: CORRALITOS CREEK, SANTA CRUZ COUNTY, CALIFORNIA.**  
Army Engineer District, San Francisco, CA.  
For primary bibliographic entry see Field 4A.  
W78-12650

**FLOOD PLAIN INFORMATION: LEVISA FORK AND TRIBUTARIES, BUCHANAN COUNTY, VIRGINIA, GRUNDY TO OAKWOOD.**  
Army Engineer District, Huntington, WV.  
For primary bibliographic entry see Field 4A.  
W78-12651

**FLOOD EMERGENCY BUILDING INSPECTOR PROGRAM FOR THE CITY OF WILKES-BARRE.**  
Wilkes-Barre Dept. of Planning and Development, PA. Bureau of Flood Recovery.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 914. Price codes: A04 in paper copy, A01 in microfiche. Economic Development Administration Technical Assistance Grant, January 1975, 66 p. 01-6 09571.70/71.

Descriptors: \*Flood damage, \*Building codes, \*Inspection, \*Floods, Buildings, Pennsylvania, Rehabilitation, Construction, Training, \*Wilkes-Barre (PA), \*Enforcement, \*Flood recovery, \*Building inspection program, Economic Development Administration, Consumer protection, Multiple inspections.

This report summarizes building inspection activities carried out by the City of Wilkes-Barre subsequent to damages caused by the Hurricane Agnes flood of June 23, 1972. The inspection program was made possible by a technical assistance grant from the Economic Development Administration. The City had taken an active role in building code enforcement prior to the flood. Without the EDA funds, the preexisting program could not have been expanded to assure that the \$70 million of rehabilitation work and new construction could be carried out by competent workmen in a safe and orderly fashion. The amount of construction work generated by the flood brought a huge influx of new contractors and workmen. The liability of poor workmanship and dishonest business practices threatened many individuals. This program emphasized consumer protection. The procedure of making multiple inspections enabled the Building Inspector's Office to act as an intermediary to assure that all the work stipulated in a contract was performed and that it was performed in accordance with Code standards. The EDA grant also allowed the City to carry out an inspection process to cover an unprecedented amount of new construction. Some of the funds were used for training purposes. (Nessa-NC)  
W78-12667

**COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, VOL. 2, APP. I: ECONOMICS; APP. II: CLIMATE AND METEOROLOGY; APP. III: HYDROLOGY, SURFACE GROUND WATER AND GEOLOGY;**

APP. IV: DRAINAGE  
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## Ecologic Impact Of Water Development—Group 6G

**APP. IV: FLOOD CONTROL AND MAJOR DRAINAGE.**

For primary bibliographic entry see Field 6B.  
W78-12761

**BIG BLACK RIVER, MISSISSIPPI—COMPREHENSIVE BASIN STUDY, VOLUME I: INTERAGENCY SUMMARY REPORT.**

For primary bibliographic entry see Field 6B.  
W78-12768

**FLOOD PLAIN ZONING.**

Wis. Stat. Ann. sec 87.30, (1972), as amended, (Supp. 1977).

Descriptors: \*Wisconsin, \*Flood plains, \*Flood plain zoning, \*Flood control, Zoning, Local governments, Floods, Flood damage, Floodways, Drainage, Ditches, Regulation.

Wisconsin's flood plain zoning statute is amended. If any local government fails to adopt an adequate flood plain zoning ordinance by 1968, the department, upon petition or by its own accord, shall determine and fix the limits of all flood plains within such division within which serious damage may occur. After public hearing the department is required to adopt a flood plain zoning ordinance applicable to that local government, except that no such ordinance shall be enacted unless the hydraulic and engineering studies necessary to determine the floodway limits have been made at state or federal expense. This last requirement was not contained in the previous statute. A final flood plain zoning ordinance required under this section does not apply to lands adjacent to farm drainage ditches if: (1) the land is not within the flood plain of a natural navigable stream or river; (2) the drainage ditches adjacent to such lands were non-navigable streams before ditching or had no previous stream history; and (3) the lands are maintained in nonstructured agricultural use. This exception was also absent from the original statute. (Quarles-Florida)  
W78-12778

**WATER MANAGEMENT DISTRICTS.**

For primary bibliographic entry see Field 4A.  
W78-12780

**6G. Ecologic Impact Of Water Development****A GUIDE TO THE NEW YORK STATE ENVIRONMENTAL QUALITY REVIEW ACT,**

Cornell Univ., Ithaca, NY.  
For primary bibliographic entry see Field 6E.  
W78-12104

**ENVIRONMENTAL IMPACT RESULTING FROM UNCONFINED ANIMAL PRODUCTION,**

Louisiana Tech Univ., Ruston. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5G.  
W78-12130

**COMPUTER-AIDED ANALYSIS OF LANDSAT DATA FOR SURVEYING TEXAS COASTAL ZONE ENVIRONMENTS,**

Purdue Univ., Lafayette, IN. Lab. for Applications of Remote Sensing.  
For primary bibliographic entry see Field 7C.  
W78-12178

**CALIFORNIA COASTAL PROCESSES STUDY - LANDSAT II. FINAL REPORT: LANDSAT INVESTIGATION NO 22200,**

Army Engineer District, San Francisco, CA.  
For primary bibliographic entry see Field 5C.  
W78-12179

**DEVELOPMENT OF A SIMPLE, RAPID FIELD TECHNIQUE FOR ESTIMATING OIL CONCENTRATIONS IN THE SEDIMENTS,**

Mississippi State Univ., Mississippi State.  
For primary bibliographic entry see Field 5A.  
W78-12182

**DEEP OCEAN MINING ENVIRONMENTAL STUDY (DOMES), PHYTOPLANKTON & PRIMARY PRODUCTIVITY STUDIES; PRELIMINARY REPORT,**

Texas A and M Univ., College Station. Dept. of Oceanography.  
For primary bibliographic entry see Field 5C.  
W78-12185

**EFFECT OF THERMAL SHOCK ON DEVELOPMENTAL STAGES OF ESTUARINE FISH,**

South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.  
For primary bibliographic entry see Field 5C.  
W78-12191

**INTERIM ENVIRONMENTAL SYNTHESIS OF THE NORTHEAST GULF OF ALASKA.**

Science Applications, Inc., Boulder, CO.  
Report Prepared for the Outer Continental Shelf Environmental Assessment Program, based on NOAA/OCSEAP Synthesis Meeting, held Anchorage, Alaska on January 11-13, 1977, March 1978. 205 p, 4 append.

Descriptors: \*Resources development, \*Baseline studies, \*Environmental effects, \*Water quality, \*Alaska, \*Water resources, Oil industry, Gases, Ecology, Fish, Birds, Mammals, Plankton, Benthos, \*Outer Continental Shelf, \*Gulf of Alaska.

Regional environmental information is provided in a form useful in decision-making processes related to OCS oil and gas development in the Northeast Gulf of Alaska (NEGOA) lease area: to increase and update scientific interdisciplinary understanding of the Northeast Gulf of Alaska region; and to identify important gaps in knowledge of the Northeast Gulf of Alaska marine environment that are relevant to OCS development. Proceedings of the meeting, material provided by the participants, and recommendations for specific research needs are organized in various chapters. Chapter II provides a description of the areas identified as being critical in view of the OCS oil and gas development. The main body of scientific knowledge is provided in Chapter III. Chapter IV outlines general conclusions reached during Synthesis Meeting discussions of the implications of oil-related impingement on the environment. Chapter V identifies gaps in knowledge and provides a summary of research needs which can be used as input for program direction and emphasis for future research. (Sinha-OEIS)  
W78-12192

**MAIN ASPECTS OF THE ANTHROPOGENIC TRANSFORMATION OF LAKE ECOSYSTEM OF THE NORTHWESTERN EUROPEAN USSR (IN RUSSIAN),**

Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.  
For primary bibliographic entry see Field 2H.  
W78-12298

**MACROINVERTEBRATE AND WATER QUALITY-QUANTITY SURVEY OF OTTER CREEK, PIUTE COUNTY, UTAH,**

Brigham Young Univ., Provo, UT. Center for Health and Environmental Studies.  
For primary bibliographic entry see Field 4D.  
W78-12303

**OCS DEVELOPMENT IN COASTAL LOUISIANA: A SOCIO-ECONOMIC IMPACT ASSESSMENT,**

New Orleans Univ., LA. Urban Studies Inst.  
For primary bibliographic entry see Field 6B.  
W78-12307

**OUTER CONTINENTAL SHELF IMPACTS, MORGAN CITY, LOUISIANA,**

University of Southwestern Louisiana, Lafayette. E. F. Stallings, T. F. Reilly, and R. B. Gramling. Southwestern Louisiana University Report to Louisiana State Planning Office, June 30, 1977. 330 p, 2 append.

Descriptors: \*Environmental effects, \*Land use, \*Louisiana, \*Resources development, Economics, Sociology, \*Outer Continental Shelf, Petroleum development, Coastal Zone Management, Morgan City(LA), Environmental impact.

Over the period 1954-1972, OCS oil production increased from 3.3 million barrels to 389.2 million barrels. Morgan City and St. Mary Parish have benefited immensely from the development of OCS petroleum and natural gas. Total employment in St. Mary Parish has increased 89.5% from 1940-1970. Parish income has increased twice as rapidly as did that of Louisiana between 1947 and 1973. OCS activities and related population growth have placed great strains upon the ability of the community to provide adequate levels of services and facilities. Land use changes have occurred on a large scale. Primarily they have involved a shift from agricultural uses to urban, residential, and industrial uses. Also, some swampland has been converted for these same three uses. OCS related industries have required land primarily for siting purposes. Environmental impacts, including pollution, directly associated with OCS activities have been small. They have generally resulted from dredging activities and from the conversion of swampland to industrial sites. However, should OCS activities decline in the area, major disruption of the social and economic life of the community would occur. (NOAA)  
W78-12310

**CHICAGO LAKEFRONT DEMONSTRATION PROJECT. ENVIRONMENTAL IMPACT HANDBOOK,**

Chicago, IL. Dept. of Development and Planning.  
For primary bibliographic entry see Field 2H.  
W78-12315

**STATE OF NORTH CAROLINA COASTAL MANAGEMENT PROGRAM AND DRAFT ENVIRONMENTAL IMPACT STATEMENT. APPENDICES.**

North Carolina Dept. of Natural Resources and Community Development, Raleigh.  
NOAA, Office of Coastal Zone Management Draft Environmental Impact Statement, Proposed Coastal Management Program for the State of North Carolina, Appendices, March 1978. 572 p, 20 infold maps.

Descriptors: \*Coasts, \*Land use, \*Resources development, \*Environmental effects, North Carolina, \*Coastal zone management, \*Environmental impact statement.

The National Environmental Policy Act (NEPA) of 1969 mandates that an environmental impact statement be prepared as part of the review and approval process of major actions by Federal government agencies which significantly affect the quality of the human environment. It is the general policy of the Federal Office of Coastal Zone Management (OCZM) to issue a combined draft environmental impact statement and program document. This document has been prepared in two volumes. Volume I contains the draft environmental impact statement and program document. Volume II contains the appendices to the program

## Field 6—WATER RESOURCES PLANNING

### Group 6G—Ecologic Impact Of Water Development

document. Part 1 of the Draft Environmental Impact Statement (DEIS) was prepared by the Office of Coastal Zone Management. Included in this section is a summary of North Carolina's Management Program which State officials have accepted as an accurate summary of the elements of the program that relate to the approval criteria in the CZMA. Part 2 of the DEIS is a description of the State's Coastal Management Program and was prepared by the State of North Carolina. Part 3 fulfills the NEPA requirements for a DEIS and was prepared by the OCZM, with some assistance from the State of North Carolina. (NOAA) W78-12334

**STATE OF NORTH CAROLINA COASTAL MANAGEMENT PROGRAM AND DRAFT ENVIRONMENTAL IMPACT STATEMENT.** North Carolina Dept. of Natural Resources and Community Development, Raleigh. NOAA, Office of Coastal Zone Management Draft Environmental Impact Statement, Proposed Coastal Management Program for the State of North Carolina, March 1978. 287 p.

Descriptors: \*Coasts, \*Land use, \*Resources development, \*Environmental effects, North Carolina, \*Coastal Zone Management, Environmental impact statement.

The National Environmental Policy Act (NEPA) of 1969 mandates that an environmental impact statement be prepared as part of the review and approval process of major actions by Federal government agencies which significantly affect the quality of the human environment. It is the general policy of the Federal Office of Coastal Zone Management (OCZM) to issue a combined draft environmental impact statement and program document. This document has been prepared in two volumes. Volume I contains the draft environmental impact statement and program document. Volume II contains the appendices to the program document. Part I of the Draft Environmental Impact Statement (DEIS) was prepared by the Office of Coastal Zone Management. Included in this section is a summary of North Carolina's Management Program which State officials have accepted as an accurate summary of the elements of the program that relate to the approval criteria in the CZMA. Part 2 of the DEIS is a description of the State's Coastal Management Program and was prepared by the State of North Carolina. Part 3 fulfills the NEPA requirements for a DEIS and was prepared by the OCZM, with some assistance from the State of North Carolina. (NOAA) W78-12335

**FRESHWATER MUSSELS UNIONIDAE, WHAT IS THEIR DISTRIBUTION IN SOUTH AFRICAN INLAND WATERS TODAY.** Albany Museum, Grahamstown (South Africa). R. A. Jubb. Piscator (Cape Town), No. 97, p 73-75, 1977, 4 ref.

Descriptors: \*Mussels, Shellfish, Species distribution, Migration patterns, Benthic fauna, Aquatic animals, Freshwater fish, Limnology, Filter feeder, Mollusca, Salt tolerance, Water temperature, Eutrophication, Lethal limit, Pollutants concentration, Bioindicators, Biomonitoring, \*Unionidae, \*South Africa.

The freshwater mussels, Unionidae, are filter feeders that, as adults, possess little means of migrating over great distances, but nevertheless the dispersal of some Southern African species is considerable. Because of peculiar adaptations during their larval stages freshwater mussels can rapidly disperse through an interconnected freshwater system. The major food sources for freshwater mussels are algae and bacteria produced by the breaking down or decomposition of organic matter in the water. Most unionids tend to flourish in the shallow parts of rich and eutrophic waters, but they are sensitive to industrial inorganic waste

matter introduced into rivers, and most insecticides, herbicides and molluscicides prove lethal. (So Afr Water Info Ctr) W78-12394

**THE TALE OF A LAKE.** Transvaal Provincial Administration, Pretoria (South Africa). Div. of Nature Conservation. For primary bibliographic entry see Field 2H. W78-12413

**THE NECESSITY OF ENVIRONMENTAL PROTECTION.** Johannesburg City Council (South Africa). R. R. Charter. Municipal Engineer, Vol. 7, No. 2, p 37, 39, 41, 43, 1976.

Descriptors: \*Environmental management, Costs, Political aspects, Research and practice, Water pollution, Water reuse, Sludge dewatering, Sludge disposal, Landfills, \*South Africa.

The author takes a close look at the environmental scene in the United States, discusses the politics behind Environmental Protection in that country and mentions the results achieved and the research done. He then goes over to discussing environmental protection in South Africa, and goes into detail into work being done by the City Council of Johannesburg regarding environmental protection. Johannesburg and the Witwatersrand is unique in that there are no large perennial rivers or adjacent coastal waters capable of diluting effluents and there may be dangers arising from steady accumulation of noxious substances during use and re-use of water. The author goes on to discuss problems concerning water pollution and water recirculation. The author, a Johannesburg City Councillor, calls for guidelines from the minister of the environment to be told where Johannesburg's responsibilities begin and end, as at present they have to make ad hoc judgements in isolation instead of in conformity with a national policy. (So Afr Water Info Ctr) W78-12435

**JOHANNESBURG ON JUKSKEI.** For primary bibliographic entry see Field 5G. W78-12454

**INTEGRATED RIVER BASIN DEVELOPMENT AND AQUATIC ECOLOGY.** K. F. Lagler. Rhodesia Science News, Salisbury, Vol 10, No 5, p 124-127, 1976.

Descriptors: \*River basin development, Integrated systems, Aquatic ecosystems, Man made lakes, Research and development, Hydroelectric power, Irrigation, \*Ecology aspects, Economic development, \*Mekong River, China, Southern Africa.

Integrated river basin development is about comprehensively blended, multiple resource usage for socio-economic gain. It involves rational, considered tradeoffs through carefully planned reductions of the ecological dysfunctions that major ecosystem alterations generate. Dams and reservoirs are implicit in most such schemes. Integrated development is best planned through applications of the principles of operations research and systems analysis. In this approach a conceptual model is attempted, based on understanding of ecosystem earth and its subsystems. The author reports the case history of the procedural model of planning for integrated river basin development of the Lower Mekong River Basin in South east Asia. (So Afr Water Info Ctr) W78-12500

**CABORA BASSA IN ITS FIRST YEAR: SOME ECOLOGICAL ASPECTS AND COMPARISONS.** P. B. Jackson, and B. R. Davies.

Rhodesia Science News, Salisbury, Vol 10, No 5, p 128-133, 1976, 18 refs, 1 tab, 1 fig.

Descriptors: \*Ecology aspects, Hydrologic data, \*Hydroelectric power, Fish growth, Research and development, Vegetation, Spawning, Macrophytes, Malaria, Schistosomiasis, Protein production, Tilapia, Water hyacinth, Fish harvest, \*Cabora Bassa, \*Southern Africa.

Closure of the Cabora Bassa Dam on December 5, 1974 led to the creation of a second large lake on the Middle Zambezi, some 200 km downstream from Kariba. The dam wall, located, about 37 km downstream from the entrance of the Cabora Bassa Gorge, which cuts through the spectacularly beautiful Songo Plateau, stands 176m high and will have a total power output of 3,870MW, making it the largest hydroelectric power project in Africa. The power, intended for use by both South Africa and Mocambique, will provide an important boost to the economy of the latter country. Various features of Kariba and Cabora Bassa are listed for comparative purposes and an outline map of Lake Cabora Bassa is shown. Cabora Bassa will be an enormous asset to the people of Mocambique, not only in terms of industrial development and protein supply, but also as a potential earner of foreign currency through export of fish products. However, extensive health hygiene and fishery training programmes, as well as sound legislation to prevent over-exploitation, are required now, in order to allow the lake to reach its full potential. Research development and management of this kind are common to all great dams of Africa. Cabor Bassa is no exception, and as a result of its morphometry and many nutrient-rich inflows it is likely to be richer than most other dams on the continent. Sound management policies for Cabora Bassa will probably be even more rewarding than has already proved to be the case in the other dams. (So Afr Water Info Ctr) W78-12501

**LIFE-FORMS OF AQUATIC PLANTS.** G. E. Russel. Rhodesia Science News, Salisbury, Vol 10, No 5, p 134-137, 1977, 6 fig.

Descriptors: \*Aquatic plants, Aquatic habitats, Floating plants, Rooted aquatic plants, Submerged plants, Riparian plants, Soil moisture zone, \*Rhodesia, \*Southern Africa.

Rhodesia is a dry country, where water availability is a limiting factor for development. Because of the critical nature of the water supply, it is important that all aspects of water and the storage of water are understood. Knowledge of aquatic plants is important in the study of aquatic habitats because their presence or absence can affect the quality and possibilities of utilization of a body of water, and they may be judged to be either beneficial or harmful depending on the uses for which the water body is intended. (So Afr Water Info Ctr) W78-12502

**DAMMING THE UMFOLOZI: ENVIRONMENTAL ASSESSMENT.** R. N. Porter. South African Journal of Science, Johannesburg, Vol 73, No 11, p 323, 1977.

Descriptors: \*Future planning, Impoundments, Hydroelectric power, Resources development, \*Environmental effect, Agriculture, Forestry, \*Umfolozi River, \*South Africa.

The Umfolozi River is one of the few major river systems in South Africa in which no significant engineering development has yet been undertaken. Further demands in South Africa for water will necessitate maximum economic use of all available resources, and thus the need and importance are recognized for impoundments on the Umfolozi

itself. In January 1976, the Minister of Water Affairs appointed a ten-man committee-known as the Committee of Inquiry into the Ecological Aspects of a Dam in the Umfolozi River which requested that the Natal Parks, Game and Fish preservation Board undertake an environmental impact assessment of the effects of proposed dams in the Umfolozi River basin. (So Afr Water Info Ctr) W78-12505

**SOME REGULARITIES IN THE CHANGES IN LAKE ECOSYSTEMS IN CONNECTION WITH ANTHROPOGENIC FACTORS (IN RUSSIAN),** Polish Academy of Sciences, Warsaw. Inst. of Ecology.

For primary bibliographic entry see Field 2H. W78-12557

**ENVIRONMENTAL IMPACT REPORTS UNDER THE CALIFORNIA ENVIRONMENTAL QUALITY ACT: THE NEW LEGAL FRAMEWORK,** San Diego Univ., CA. School of Law.

For primary bibliographic entry see Field 5G. W78-12563

**REMOTE SENSING TO IDENTIFY, ASSESS, AND PREDICT ECOLOGICAL IMPACT ON LAKE CHAMPLAIN WETLANDS,** State Univ. of New York Coll. at Plattsburgh. D. J. Bogucki, and G. K. Gruendling.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 339. Price codes: A10 in paper copy, A01 in microfiche. Final Report, 1978. 191 p, 8 fig, 36 tab, 10 plates, 66ref. OWRT C-6075 (5210)(1).

Descriptors: \*Lake Champlain, \*Wetlands, \*Remote sensing, \*Water level regulation, New York, \*Aquatic vegetation, Vermont, Ecology, Ecological distribution, Environmental effects, Aerial photography, Pre-impoundment.

The objectives were to (1) utilize remote sensing techniques (color and color infrared photography) to map aquatic vegetation for 12 priority Lake Champlain wetlands (9135 hectares) at a 1:2500 scale, (2) analyze the ecological effects of naturally fluctuating lake levels on the composition and distribution of major aquatic plant populations, and assess the possible effects of water level regulation from the proposed Richelieu River dam construction. Evaluation of the effects of naturally fluctuating water levels on selected aquatic vegetation over a three year period indicated that certain floating, emergent, and shrub species (particularly *Typha angustifolia*, *Sparganium eurycarpum*, *Scirpus fluviatilis*, *Cephalanthus occidentalis*, *Nuphar variegatum*, and *Nymphaea tuberosa*) benefit from high water levels. All showed decreases in distribution, density, and/or vigor during the 1975 and 1977 low water years. Low water conditions appear most favorable for the emergent *Zizania aquatica* and for the maintenance of the green timber areas. If Lake Champlain should be regulated, each of the Lake Champlain wetlands would react in a different manner. The varied present day wetland characteristics with respect to vegetation composition, slope, exposure, soils, and basin configuration all combine to result in a wide range of possible ecological impacts. W78-12601

**TRANSITION ZONES OF FORESTED INLAND WETLANDS IN NORTHEASTERN CONNECTICUT,** Connecticut Univ., Storrs. Inst. of Water Resources.

P. H. Anderson, M. W. Lefor, and W. C. Kennard. Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 983. Price codes: A06 in paper copy, A01 in microfiche. Institute Report No. 29, Sept. 1978. 92 p, 10 fig, 17 tab, 86 ref, 3 append. OWRT A-058-CONN(3), 14-31-0001-4007.

Descriptors: \*Wetlands, \*Hydrologic cycles, \*Remote sensing, \*Plant populations, \*Forested inland wetlands, \*Transition zones, \*Index of abundance, \*Vegetation distribution, \*Soil water content, \*Relief, \*Connecticut.

Inland wetlands are valuable natural resources intimately associated with the hydrologic cycle. This study was designed to (1) investigate vegetation distribution and selected physical and chemical properties of wetland and bordering upland soils and the interface between the two, and (2) provide the ground truth necessary for the identification and delineation of deciduous wetland forests using false-color infrared (FCIR) imagery. All study sites were within the 45 sq. mile Town of Mansfield in northeastern Connecticut. Field research was conducted during the growing season of 1975. Line transects were laid out across wetland to upland transition zones. Plant species were identified and their positions on line transects were recorded. Crown cover was determined for herb layers, shrubs layers and the tree canopy. Changes in soil water content, soil pH, depth to water table and elevations were determined along the transects. In order to describe the distribution of plant species among the various zones (wetland, transition, upland), a statistical 'index of abundance' was developed. Discriminant analysis applied to the abundance data showed which plant species best separate wetlands from uplands and which are representative of natural plant associations. Of the criteria studied, vegetation distribution, soil water content and relief are the most useful for delineating deciduous wetland forests. These results are valuable for identifying and delineating inland wetlands using remote sensing imagery. (DeLara-Conn) W78-12609

**PROCEEDING OF ENVIRONMENTAL IMPACT STATEMENT CONFERENCE, HELD AT KANSAS CITY, MISSOURI ON 8-9 NOVEMBER, 1972.**

Environmental Protection Agency, Kansas City, MO.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 335. Price codes: A06 in paper copy, A01 in microfiche. November 1972, 115 p.

Descriptors: \*Fossil fuels, \*Environmental control impacts, \*Conservation, \*Environmental effects, Construction, Transportation, Water resource development, \*National Environmental Policy Act (NEPA), \*Environmental design, \*Environmental Impact Statements, \*Environmental impacts, Bureau of Reclamation, Research and education, Soil Conservation Service, Ecology, Corps of Engineers.

This volume is a compilation of papers presented by all speakers who participated in the Environmental Impact Statement Conference. The Conference was called to illuminate various dimensions of Environmental Impact Statements (EIS). The great number of lawsuits filed against responsible Federal agencies by environmental groups or individuals has proven to the conference sponsors that the EIS laws will be enforced. The proceedings deal with the different problems arising out of mandatory EIS. The transportation and construction industries, fossil fuel power stations, Bureau of Reclamation, Soil Conservation Service and Corps of Engineers all face peculiar problems with regard to drafting EIS. Additional articles cover the origins and history of NEPA, conservationist and ecologist public attitudes toward EIS, and a general discussion of environmental design. The participants are consultants, lawyers, and professors from the Kansas-Missouri area. (Conn-NC) W78-12657

**PLAN AND CONCEPTS FOR MULTI-USE MANAGEMENT OF THE ATCHAFALAYA BASIN.**

Coastal Environments, Inc., Baton Rouge, LA. J. L. Van Beek, W. G. Smith, J. W. Smith, and P. Light.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 488. Price codes: A10 in paper copy, A01 in microfiche. Report EPA-600/3-77-062, May, 1977. 204 p, 44 fig, 14 tab, 70 ref, 2 append.

Descriptors: \*Swamps, \*Wildlife habitat, \*Hydrography, \*Louisiana, \*Flood control, \*Water resources development, Wetlands, Wildlife, Deltas, Forestry, Sedimentation, Water quality, Runoff, Water management (Applied), Channel improvement, Atchafalaya Basin (Louisiana).

A surface-water management plan is presented that is believed to provide for maximum longevity of the remaining Atchafalaya Basin swamp ecosystem, to minimize the conflict arising from flood control needs, and to make possible compatible derivation of benefits from both renewable and non-renewable resources. Surface water requirements are determined for the natural resource complex, including fishes, wildlife, forests, and the socio-economic resource uses, including flood control, urban and industrial development, mineral extraction, transportation, agriculture, and recreation. Requirements are expressed in terms of desirable annual water-level variation, and resulting hydrographs are compared with those for present and proposed conditions associated with channelization. Minimum volumetric inflow requirements were calculated on the basis of storage characteristics and water levels as attained at present. Hydraulic geometry at the present main river channel is analyzed, and those channel dimensions that are in equilibrium with bankfill discharge suggest that channel enlargement through dredging should not go beyond a cross-sectional area of 7,400 sq. m. (Steiner-Mass) W78-12686

**ENVIRONMENTAL PLANNING FOR OFFSHORE OIL AND GAS -- VOLUME III, EFFECTS ON LIVING RESOURCES AND HABITATS.**

Conservation Foundation, Washington, DC. For primary bibliographic entry see Field 5G. W78-12697

**MONTANA'S YELLOWSTONE RIVER: WHO GETS THE WATER.**

For primary bibliographic entry see Field 6E. W78-12699

**OIL AND GAS AND SULPHUR OPERATIONS IN THE OUTER CONTINENTAL SHELF.**

Geological Survey, Washington, DC. Federal Register, Vol. 43, No. 19, p 3880-87, January 27, 1978.

Descriptors: \*Geological surveys, \*Continental shelf, \*Exploration, \*Regulation, Mineral industry, Oil, Sulphur, Leases, State governments, Local governments, Environmental effects, Geologic investigations.

These regulations revise and define existing procedures for the submission by oil and gas lessee on the Outer Continental Shelf of plans for exploration and development activities on the shelf. The regulations also expand the information which states affected by development of the shelf will receive, and provide commenting procedures for affected states and local governments. Procedures for determining whether or not an Environmental Impact Statement will be required for exploration and development/production plans are outlined. The basic requirement that no exploration activities may commence until such activities have been



## Field 6—WATER RESOURCES PLANNING

### Group 6G—Ecologic Impact Of Water Development

approved has been amended to allow preliminary activities to begin prior to submission and approval of a plan. Preliminary activities include limited surveys in order that lessees be able to gather sufficient information to prepare an initial exploration plan. The regulations define the procedure for determining the need for an environmental impact statement so that it complies with the National Environmental Policy Act. Requirements for environmental impact statements and the environmental reports that go to affected states are set forth. A discussion of major comments received after initial publication of the proposed regulations is also included. (Quarles-Florida)

W78-12701

#### DESCRIPTION OF THE ECOREGIONS OF THE UNITED STATES.

Forest Service (USDA), Ogden, UT.  
May 1978. 77 p, 1 map. Compiled by Robert G. Bailey.

Descriptors: \*Ecosystems, Environment, \*United States, Regional analysis, \*Regions(US), Climates, Vegetation, Soils, Wildlife, \*Ecoregions(US), Geomorphology, \*Land classification, Polar domain(US provinces), Humid temperature domain(US provinces), Dry domain(US provinces), Humid tropical domain(US provinces).

This manual is a companion publication to a map titled 'Ecoregions of the United States', published in 1976, which shows an initial attempt to systematically divide the country into ecosystem regions. This map, along with a brief narrative that described the approach and development of the system, is now being used in making assessments required by the 1980 Resources Planning Act and in the Roadless Area Review and Evaluation (RARE II) program. The supporting descriptions of the areas shown on the map are published here. They make the meaning of the map clearer and further explain the principles of the classification system. The objective has been to provide a broad synthesis of current knowledge about the ecosystem geography of the country that may be a useful reference for persons who desire an overview on a comparable basis. This publication gives, for each province, a brief description of the dominant physical and biological characteristics, under five headings: land-surface form, climate, vegetation, soils, and fauna. The descriptions are based on information compiled from many sources. Land-surface form is described using the terminology and classification of E.H. Hammond (1964). Climate descriptions are based largely on Koppen's classification (1931). Soil information is given by naming the principal soil orders of the Soil Taxonomy (Soil Survey Staff 1975). The approximate area of each province and section, and the proportionate extent of each in the United States are listed in an appendix.

W78-12749

#### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, VOLUME 1: SUMMARY REPORT.

For primary bibliographic entry see Field 6B.

W78-12760

#### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, TEXAS. VOL. 5, APP. VII: MINERAL RESOURCES AND MINERAL INDUSTRY: APP. IX: ARCHEOLOGICAL, HISTORICAL AND NATURAL RESOURCES: APP. X: HYDROELECTRIC POWER.

For primary bibliographic entry see Field 6B.

W78-12764

#### COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA AND TEXAS, APP. XI: WATER SUPPLY & WATER QUALITY CONTROL: APP. XII: OUTDOOR RECREATION: APP. XIII: FISH & WILDLIFE.

For primary bibliographic entry see Field 6B.

W78-12765

#### BIG BLACK RIVER, MS: COMPREHENSIVE BASIN STUDY: VOL. IV, AN. C--RECREATION ASPECTS: AN. D--FISH & WILDLIFE RESOURCES: AN. E--MUNICIPAL & INDUSTRIAL WATER SUPPLY & WATER QUALITY CONTROL: AN. F--GEOLOGY & WATER RESOURCES: AN. G--ARCHEOLOGICAL, HISTORIC, & NATURAL RESOURCES.

For primary bibliographic entry see Field 6B.

W78-12771

#### THE EFFECT OF PRUDHOE BAY CRUDE OIL ON A TIDAL-FLAT ECOSYSTEM IN PORT VALDEX, ALASKA,

Alaska Univ., College Station.

For primary bibliographic entry see Field 5C.

W78-12803

#### ENVIRONMENTAL ASSESSMENT OF THE BUCCANEER OIL AND GAS FIELD OFF GALVESTON, TEXAS: AN OVERVIEW.

For primary bibliographic entry see Field 5C.

W78-12807

#### ASSESSMENT OF ENVIRONMENTAL IMPACT OF OFFSHORE PRODUCTION IN THE BUCCANEER OIL FIELD: SEDIMENTOLOGICAL AND GEOCHEMICAL RESULTS,

Rice Univ., Houston, TX.

For primary bibliographic entry see Field 5C.

W78-12808

#### OCEAN MINING AND PROTECTION OF THE MARINE ENVIRONMENT IN THE RED SEA,

For primary bibliographic entry see Field 5G.

W78-12809

#### ENVIRONMENTAL HAZARDS ON THE ATLANTIC OUTER CONTINENTAL SHELF OF THE UNITED STATES,

D. W. Folger, B. Butman, and H. J. Knebel.

In: Proceedings Tenth Annual Offshore Technology Conference, held in Houston, TX, May 8-11, Vol. 4, p 2293-2306, 1978. 13 fig, 2 tab, 25 ref. OTC No. 3313.

Descriptors: \*Hazards, \*Water pollution effects, \*Resources development, \*Sediments, Environmental effects, Oil spills, \*Outer Continental Shelf, \*Geologic hazards, U.S. East Coast, Petroleum resources.

Environmental studies have been carried out within the Georges Bank area off the New England States and the Baltimore Canyon Trough area off the Middle Atlantic States. These baseline studies have concentrated mainly on the identification and assessment of natural geologic hazards that might cause or distribute oil spills during exploration, development, and production operations. Major hazards on Georges Bank are associated with the high-speed currents driven by tides, storms, and waves; the mobility of the abundant surficial coarse detritus of glacial origin in response to the vigorous hydrologic regime; the highly variable texture of the substrate that may be unstable in response to loading; and the clockwise movement of water around the bank, which might entrain pollutants for a long time. However, none of the hydrologic or geologic hazards thus far observed in the two areas preclude exploration or development. Further basic and regional research should be pursued to ascertain the causes and mechanisms of sediment instability. (Sinha-OEIS)

W78-12810

#### A NOTE ON THE USE OF PROPERTY VALUES IN ESTIMATING MARGINAL WILLINGNESS TO PAY FOR ENVIRONMENTAL QUALITY,

Handelshogskolan i Stockholm (Sweden).

For primary bibliographic entry see Field 5G.

W78-12879

#### DESERTIFICATION PROCESSES AND THE SEARCH FOR SOLUTIONS,

Ben Gurion Univ. of the Negev, Beersheba (Israel). Research and Development Authority.

For primary bibliographic entry see Field 4C.

W78-12921

#### CAN DESERTIZATION BE STOPPED. SUMMARY AND RECOMMENDATIONS,

United Nations, New York. Environment Programme; and Secretariat for International Ecology (Sweden).

For primary bibliographic entry see Field 6E.

W78-12937

## 7. RESOURCES DATA

### 7A. Network Design

#### DESIGN CONSIDERATIONS FOR AMBIENT STREAM QUALITY MONITORING,

Washington Univ., Seattle. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5A.

W78-12154

#### PHYTOPLANKTON SAMPLING IN QUANTITATIVE BASELINE AND MONITORING PROGRAMS,

Virginia Inst. of Marine Science, Gloucester Point.

For primary bibliographic entry see Field 5A.

W78-12247

#### GUIDELINES FOR ZOOPLANKTON SAMPLING IN QUANTITATIVE BASELINE AND MONITORING PROGRAMS,

Virginia Inst. of Marine Science, Gloucester Point.

For primary bibliographic entry see Field 5A.

W78-12249

#### HYDAC-100 - AN AUTOMATED SYSTEM FOR HYDROGRAPHIC DATA ACQUISITION AND ANALYSIS,

Department of the Environment, Ottawa (Ontario). Water Resources Branch.

For primary bibliographic entry see Field 7C.

W78-12253

### 7B. Data Acquisition

#### LOCATING DRAINAGE SYSTEMS BY MAGNETOMETER SURVEYS,

Toledo Univ., OH. Dept. of Geology.

For primary bibliographic entry see Field 8G.

W78-12142

#### PHYSICAL MEASUREMENTS OF RIVER ICE JAMS,

Army Terrestrial Sciences Center, Hanover, NH.

For primary bibliographic entry see Field 2C.

W78-12148

#### AN AIRLIFT SAMPLING DEVICE FOR IN SITU COLLECTING OF BIOTA FROM ROCKY SUBSTRATA,

National Marine Fisheries Service, Tiburon, CA.

J. R. Chess.

## RESOURCES DATA—Field 7

### Data Acquisition—Group 7B

Marine Technology Society Journal, Vol. 12, No. 3, p 20-23, 1978. 2 fig, 4 ref.

Descriptors: \*Sampling, \*Biological communities, \*Bottom sampling, On-site data collections, Benthic fauna, Benthic flora, Equipment, Aquatic populations, Research equipment, Coasts, Methodology, \*Airlift sampling.

Problems inherent in collecting organisms from the rocky sublittoral zone have undoubtedly limited study of this habitat. Most investigation of benthic biology have dealt with assemblages of organisms on soft or unconsolidated substrata. This report describes a driver-operated airlift sampling device designed to collect organisms on rocky substrata. It is inexpensive but durable, made of readily available materials, and requires neither special talents nor tools for construction or operation. Most important, with it quantitative samples can be taken. (EIS-Deal)

W78-12242

#### A GUIDE TO GAUGING STATION INSPECTION,

Department of the Environment, Ottawa (Ontario). Water Resources Branch. R. A. Terzi.

1972. 21 p, 16 fig, 9 ref.

Descriptors: \*Gaging stations, \*Equipment, \*Inspection, \*Installation, Water levels, Water level recorders, Crest stage gages, Water level fluctuations, Water measurement, Methodology, Telemetry, Sediments, Sampling, On-site tests, Hydrometric data, Staff gages, Slope gages, Wire weight gages, Recording gages, Manual gages, Water level data, Servicing, Sensing.

The primary purpose of a gauging station is to provide a means by which hydrometric data may be systematically gathered. Stage (water level) information together with discharge records are derived. Some of the stage data are collected mechanically; and automatically by way of strip-chart recorders which produce accurate permanent records. Others are obtained manually through the use of trained observers who, by means of gauges or measuring devices, observe and record water levels at prescribed intervals, generally twice daily. At present, the Water Survey of Canada operates approximately 2400 gauging stations across Canada. The construction and maintenance of gauging stations is the responsibility of the District in which the station is located. These offices must be informed of necessary repairs and maintenance or of acts of vandalism at gauging stations. Any conditions which might lead to missing record must be corrected as quickly as possible. (WATDOC)

W78-12260

#### THE ESTIMATION OF SAMPLE SIZE REQUIRED IN CHEMICAL LIMNOLOGY AND AUTECOLOGY OF SHELL INVERTEBRATES,

Canada Centre for Inland Waters, Burlington (Ontario).

L. D. Delorme, and A. H. El-Shaarawi.

Scientific Series No. 85, 1978, 4 p, 1 fig, 4 ref, 3 tab.

Descriptors: \*Estimating, \*Sampling, Size, \*Limnology, \*Water chemistry, \*Invertebrates, \*Shellfish, Parametric hydrology, Ponds, Lakes, Canada, \*Autecology, \*Lake Kipabiskaw, etc.—atchewan.

Calculation of sample size is based on the central limit theorem for a normal distribution with mean zero, variance unity and the tail value equal to ALPHA. The confidence coefficient is 1 to 2 ALPHA. In the field of chemical limnology and autecology of shelled invertebrates, most chemical parameters must be transformed to obtain a normal distribution. The exception is pH, which is al-

ready transformed. Some parameters, such as carbonate and carbon dioxide, have an exponential distribution because of the carbonate-bicarbonate fence at pH 8.3. The sample size is a function of the parameter measured, primarily variance, mean and range. (WATDOC)

W78-12262

#### AERIAL SURVEILLANCE TO MONITOR WATER QUALITY IN CATFISH PONDS,

Mississippi State Univ., Mississippi State. Dept. of Wildlife and Fisheries.

For primary bibliographic entry see Field 5A.

W78-12526

#### REMOTE SENSING TO IDENTIFY, ASSESS, AND PREDICT ECOLOGICAL IMPACT ON LAKE CHAMPLAIN WETLANDS,

State Univ. of New York Coll. at Plattsburgh.

For primary bibliographic entry see Field 6G.

W78-12601

#### STUDIES OF TRACE METALS IN THE WATERS AND SEDIMENTS OF BADFISH CREEK AND LAKE WINGRA, NEAR MADISON, WISCONSIN,

Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.

For primary bibliographic entry see Field 5A.

W78-12603

#### PREDICTION OF ASSIMILATION CAPACITY IN SMALL RECEIVING STREAMS,

Oklahoma State Univ., Stillwater. School of Civil Engineering.

For primary bibliographic entry see Field 5B.

W78-12604

#### TRANSITION ZONES OF FORESTED INLAND WETLANDS IN NORTHEASTERN CONNECTICUT,

Connecticut Univ., Storrs. Inst. of Water Resources.

For primary bibliographic entry see Field 6G.

W78-12609

#### THE WORLD REMOTE SENSING BIBLIOGRAPHIC INDEX,

Tensor Industries, Inc., Falls Church, VA.

P. F. Krumpke.

December 1976. 628 p.

Descriptors: \*Remote sensing, \*Bibliographies, \*Indexing, \*United States, Publications, Geographical regions, Agriculture, Natural resources, Resources, Foreign countries, Education, Environment, Agricultural resources, World index.

This volume is a geographic index bibliography of over 4,000 references on remote sensing of natural and agricultural resources throughout the world. Citations from 1970 to August 1976 are arranged within 14 major disciplines among more than 150 geographic areas, states, and countries. This extensive compilation originates from more than 850 foreign and domestic sources among 6 major publishing categories. Instructions for procuring desired publications or reports were included, in addition to guidelines for efficient utilization of the document. This book was designed as an integrated reference guide for use in remote sensing and environmental education, training, applications research, analysis, and technology transfer. (Froehlich-ISWS)

W78-12618

#### A MULTILEVEL DEVICE FOR GROUND-WATER SAMPLING AND PIEZOMETRIC MONITORING,

Department of the Environment, Ottawa (Ontario). Hydrology Research Div.

J. F. Pickens, J. A. Cherry, G. E. Grisak, W. F. Merritt, and B. A. Risto.

Ground Water, Vol 16, No 5, p 322-327, September-October 1978. 5 fig, 1 tab, 7 ref.

Descriptors: \*Sampling, \*Groundwater, \*Instrumentation, \*Potentiometric level, Piezometers, Water levels, Water levels, Aquifers, Wells, Landfills, Leachate, Screens, \*Pollutant identification, PVC pipe.

A simple, inexpensive device for sample collection and for monitoring of groundwater potential at many levels from a single borehole installation was developed. The device consists of a bundle of polypropylene tubes contained inside a polyvinyl chloride (PVC) pipe that is installed in the aquifer. Each tube protrudes through the wall of the pipe at a different elevation where it serves as a point water sampler and piezometer. The tip of each tube is encased in fine-meshed stainless-steel screening. The device is best suited for use in cohesionless deposits and where the piezometric levels are close enough to ground surface to enable samples to be obtained by suction methods. It can be installed conveniently using a hollow-stem auger, driven casing, or wash-boring methods. The usefulness of this multilevel sampling device has been demonstrated in detailed monitoring of a leachate plume from a sanitary landfill. (Visocky-ISWS)

W78-12636

#### A FIELD-MEASURING INSTRUMENT OF SATURATED PERMEABILITY KF IN UNDISTURBED SOIL SAMPLES BY THE CORE-SAMPLER METHOD,

Geologisches Landesamt Nordheinestfalen, Krefeld (West Germany).

For primary bibliographic entry see Field 2G.

W78-12638

#### DIFFERENCES IN RADAR RETURN FROM ICE-COVERED NORTH SLOPE LAKES,

Army Terrestrial Sciences Center, Hanover, NH.

For primary bibliographic entry see Field 2C.

W78-12639

#### A CASE STUDY OF THE MEASUREMENT OF SNOWFALL BY RADAR: AN ASSESSMENT OF ACCURACY,

British Meteorological Office, Bracknell (England).

For primary bibliographic entry see Field 2C.

W78-12644

#### REMOTE SENSING FOR IDENTIFICATION AND CLASSIFICATION OF WETLAND VEGETATION,

Fisheries and Wildlife, Jamestown ND. Northern Prairie Wildlife Research Center.

For primary bibliographic entry see Field 2I.

W78-12689

#### VARIABILITY OF WETLAND REFLECTANCE AND ITS EFFECT ON AUTOMATIC CATEGORIZATION OF SATELLITE IMAGERY,

Delaware Univ., Newark. Center for Remote Sensing.

V. Klemas, and D. Eartlett. Available from the National Technical Information Service, Springfield, VA 22161 as N77-21505. Price codes: A02 in paper copy, A01 in microfiche. Goddard Space Flight Center, Greenbelt, Maryland. January 10, 1977. 1 p.

Descriptors: \*Remote sensing, \*Delaware, \*Tidal marshes, Wetlands, Mapping, Marshes, Marsh plants, Tides, Shore-line cover, Spatial distribution, LANDSAT, Multispectral data.

## Field 7—RESOURCES DATA

### Group 7B—Data Acquisition

A technique for automated analysis of satellite (LANDSAT) multispectral data based on in situ measurements of target reflectance was tested and applied in delineating cover types in Delaware's tidal wetlands. The technique evaluated in situ measurements of target radiance and an atmospheric correction procedure to derive reflectance signatures for land-cover categories. Significant correlations were found between single band reflectances and tidal inundation and plant morphologic characteristics. (Steiner-Mass)  
W78-12690

**INSECTS AND WETLANDS,**  
Michigan Univ., Ann Arbor. School of Natural Resources.  
J. A. Witter, and S. Croson.  
In: Freshwater Wetlands and Sewage Effluent Disposal: Proceedings of a National Symposium held at the University of Michigan, Ann Arbor, May 10-11, 1976, p 269-295, 1976, 2 tab, 33 ref.

Descriptors: \*Insects, \*Wetlands, \*Trapping, \*Indicators, \*Census, Invertebrates, Marshes, Methodology, Sampling, \*Michigan, Population, Estimating, \*Houghton Lake(Mich).

Six relative methods (Malaise traps, pitfall traps, light traps, bait traps, sticky traps, sweeping) and three absolute methods (emergence traps, unit of soil, unit of vegetation) of estimating population numbers of wetland insects are discussed. Relative sampling methods are easier and less expensive to use in most situations. Insect indicator species may serve as indices of changes in specific parameters or they may indicate broader changes, such as changes in environmental quality or community structure. Criteria to consider when selecting indicator species are presented. During an exploratory study in Houghton Lake Marsh, Michigan, 82 and 45% of all insects collected in Malaise traps and light traps were Diptera, respectively. Fourteen orders and 168 families were present in the samples. (See also W78-12707) (Stihler-Mass)  
W78-12719

**MULTISPECTRAL REMOTE OBSERVATIONS OF HYDROLOGIC FEATURES ON THE NORTH SLOPE OF ALASKA,**  
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.  
For primary bibliographic entry see Field 2C.  
W78-12832

**INVENTORY OF WATER RESOURCES RESEARCH IN AUSTRALIA, 1976.**  
Australian Water Resources Council, Canberra Dept. of National Resources.  
For primary bibliographic entry see Field 2A.  
W78-12833

**FIELD CALIBRATION AND USE OF THE NEUTRON MOISTURE METER ON SOME NIGERIAN SOILS,**  
Ibadan Univ. (Nigeria). Dept. of Agronomy.  
For primary bibliographic entry see Field 2G.  
W78-12843

**TURBULENT FREE CONVECTION IN FRESH AND SALT WATER: SOME CHARACTERISTICS REVEALED BY VISUALIZATION,**  
Washington Univ., Seattle. Dept. of Atmospheric Sciences.  
For primary bibliographic entry see Field 2L.  
W78-12856

**PROCEEDINGS OF THE 3RD AQUATIC TOXICITY WORKSHOP HELD IN HALIFAX, NOVA SCOTIA, NOVEMBER 2-3, 1976.**  
Environmental Protection Service, Halifax (Nova Scotia).  
For primary bibliographic entry see Field 5A.

W78-12952

### 7C. Evaluation, Processing and Publication

**GENERATING STREAMFLOW SEQUENCES WITH TREND AND CYCLICAL MOVEMENTS,**  
Florida Univ., Belle Glade. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 2E.  
W78-12157

**ESTABLISHING BASELINE DATA FOR MANAGEMENT OF HALIFAX, N.S., LAKE WATERSHEDS,**  
Nova Scotia Technical Coll., Halifax. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5A.  
W78-12159

**COMPREHENSIVE ANALYSIS OF WATER-TABLE AQUIFER TEST DATA,**  
Upper Mississippi River Basin Commission, Twin Cities, MN. Minnesota.  
For primary bibliographic entry see Field 4B.  
W78-12165

**COMPUTER-AIDED ANALYSIS OF LANDSAT DATA FOR SURVEYING TEXAS COASTAL ZONE ENVIRONMENTS,**  
Purdue Univ., Lafayette, IN. Lab. for Applications of Remote Sensing.  
S. J. Kristof, and R. A. Weismiller.  
Available from the National Technical Information Service, Springfield, VA 22161 as E78-10018, Paper copy, A03 in paper copy, A01 in microfiche. Report No. LARS Tech Rept 090677, to NASA/Johnson Space Center, September 1977, 32 p, 22 fig, 2 tab, 7 ref. NAS9-14016, NAS9-14970.

Descriptors: \*Remote sensing, \*Coasts, \*Texas, \*Baseline studies, Resources, Water resources, Environmental effects, Pollution, Geomorphology, Outer Continental Shelf, Coastal zone.

A study was conducted to determine the feasibility of using machine-aided processing of LANDSAT data to inventory environmental units within the Texas coastal zone. The analysis was conducted on Landsat data collected on November 27, 1972 and February 25, 1975 over the Matagorda Bay area of the Texas coastal estuarine system. The following terrestrial and aquatic environments were discriminated: alternating beach ridges, swales, sand dunes, beach berms, deflation surfaces, land-water interface, urban, spoil areas, fresh and salt water marshes, grass and woodland, recently burned or grazed areas, submerged vegetation and waterways. Visual observation of results obtained from both the November 1972 and February 1975 data indicate that no major differences existed in the land resource maps. The results did show that analysis of Landsat data with computer-aided techniques is a viable technique for surveying coastal features. (Sinha-OEIS)  
W78-12178

**CALIFORNIA COASTAL PROCESSES STUDY - LANDSAT II FINAL REPORT: LANDSAT INVESTIGATION NO 22200,**  
Army Engineer District, San Francisco, CA.  
For primary bibliographic entry see Field 5C.  
W78-12179

**COMPUTER ESTIMATES OF NATURAL RECHARGE THROUGH SOILS IN SOUTHERN ARIZONA, U.S.A.,**  
Geological Survey of Israel, Jerusalem; and Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.  
For primary bibliographic entry see Field 2F.  
W78-12232

**HYDAC-100 - AN AUTOMATED SYSTEM FOR HYDROGRAPHIC DATA ACQUISITION AND ANALYSIS,**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
J. Y. Durette, and P. Zrymiak.  
Technical Bulletin No. 105, 1978, 43 p, 20 fig, 9 ref, 4 tab.

Descriptors: \*Automation, \*Hydrograph analysis, \*Data processing, \*Data collections, Editing, Systems analysis, Computers, Computer programs, Hydrologic data, Geomorphology, Analysis, Surveys, Methodology, Application methods, Information retrieval, Future planning(Projected), Volumetric analysis, Canada, Water analysis, \*HYDAC-100, Positioning sub-system, Depth sounding sub-system, Data accumulation sub-system, Data processing sub-system, Power supply.

In recent years there has been an increasing demand for more complete and accurate information on hydrological and geomorphological processes in Canadian waters. Obtaining this type of information requires collection of massive amounts of data, rapid editing of all data and careful analysis of the results. To cope with these demands, the Sediment Survey Section of the Applied Hydrology Division has developed an automated high-speed data collection and processing system (HYDAC-100) and a computerized data reduction and analysis system (HYDRA). This paper provides information on the development and description of the HYDAC-100 system, a description of the survey to which the HYDAC system may be applied, the typical HYDAC-100 survey procedure, the development and description of the HYDRA system and an outline of possible future developments. (WATDOC)  
W78-12253

**COMPUTER PROGRAM FOR CALCULATING ATMOSPHERIC PLANETARY WAVES,**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
S. Fogarasi, and M. Strome.  
1978, 8 p, 3 fig, 8 ref, 2 tab, 6 append.

Descriptors: \*Computer programs, \*Analytical techniques, \*Atmospheric pressure, \*Atmospheric physics, Monthly, Height, Climatology, Winds, Wind pressure, Weather, Polar coordinates, Cartesian coordinates, Polar stereographic plots, Cartesian plots, \*Planetary waves, Calculations, Fortran IV, Conrad and Pollak's technique, 700-MB pressure surface, Plotting.

A harmonic analysis technique is translated into Fortran IV computer language. The generalized program is especially suitable for analyzing upper level pressure charts along one or several latitude circles. Analysis of the 1976 monthly mean heights of the 700-mb surface is demonstrated, and the calculated harmonic waves are plotted in both polar and Cartesian coordinates. This technique could be applied to studies on climatic variation. Derivation of hemisphere waves is explained; selected examples are shown and interpreted. (WATDOC)  
W78-12254

**WATER QUALITY DATA, MANITOBA, 1961-1976.**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
For primary bibliographic entry see Field 5A.  
W78-12255

**IFYGL TEMPERATURE TRANSECTS, LAKE ONTARIO, 1972,**  
Canada Centre for Inland Waters, Burlington (Ontario); and Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.  
For primary bibliographic entry see Field 2H.  
W78-12256



**A GUIDE TO GAUGING STATION INSPECTION.**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
For primary bibliographic entry see Field 7B.  
W78-12260

**LABS11 - A LABORATORY DATA MANAGEMENT SYSTEMS.**  
Department of the Environment, Moncton (New Brunswick). Water Quality Branch.  
1978, 45 p, 10 fig, 4 tab, append.

Descriptors: \*Laboratory equipment, \*Laboratory tests, \*Computer models, \*Computer programs, \*Sampling, Analysis, Analytical techniques, Data collections, Data processing, Data storage and retrieval, \*LABS11 Data Management System, \*Laboratory instruments.

LABS11 is a data management system designed for an operational laboratory which handles between 2000 and 3000 samples per year. The system was developed and implemented on a PDP-11/10 mini-computer. A modular design was used to minimize the memory requirements of each step in the overall system. The system is interactive allowing up to five simultaneous users. Five principal programs exist to initialize samples received onto the samples-in-progress files, produce worksheets for different sections of the laboratory, enter analytical values, validate analytical results and transfer the completed samples to a permanent file. The system has resulted in time saving in the logging, filing and validating of analytical results and has improved the integrity of data being supplied to all users. (WATDOC)  
W78-12261

**EXTENSION OF THE HISARS SYSTEM.**  
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.  
E. H. Wiser.  
Paper presented at ASAE Winter Meeting, Palmer House Hotel, Chicago, Ill., 12/13-16, 1977. 11 p, 4 fig, 9 ref. OWRT A-999-NC(52), 14-34-0001-8035.

Descriptors: \*Computer programs, \*Data storage and retrieval, \*Climatic data, Storage, Streamflow, Rainfall, Temperature, \*Hydrologic data, \*Data collections, \*HISARS.

Modellers have often been faced with a substantial part of their time being consumed by assembling data, storing it in a computer-accessible form and retrieving it as required. Faced with these problems, a computer system for storage, retrieval, and processing of hydrologic, climatological, and related data has been developed at North Carolina State University. The system is known as HISARS (Hydrologic Information Storage and Retrieval System). System characteristics and capabilities include: storage of daily streamflow records, daily rainfall records, daily temperature records, hydrographic records of streamflow and rainfall, hourly rainfall records, daily evaporation and wind movement records, daily snowfall and snow depth records, daily event ('days with') records, annual flood peak records, dam characteristics, environmental resources, and water temperature records (evaporation pans). Extension of the Hydrologic Information Storage and Retrieval System (HISARS) are reviewed. Included are data and program extensions, as well as linkage to external programs. Possible future extensions are also considered. (Kiger-NC State)  
W78-12276

**'BASELINE MONITORING STUDIES, MISSISSIPPI, ALABAMA, FLORIDA, OUTER CONTINENTAL SHELF, 1975-1976' VOLUME III, RESULTS.**  
State Univ. System of Florida Inst. of Oceanography, St. Petersburg.  
J. E. Alexander, T. T. White, K. E. Turgeon, and A. W. Blizard.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 803. Price codes: A21 in paper copy, A01 in microfiche. Report BLM ST-78-32, June 1977, 482 p. MAFLA, yr. 2 (1975-76), No. 08550-CT5-30.

Descriptors: Marine biology, Chemical oceanography, Primary productivity, Hydrology, Systematics, \*Monitoring, \*Baseline studies, Miss-Ala-Fla area, \*Outer Continental Shelf, Hydrocarbons, Trace elements, Benthos, Histopathology, Hurricane, Florida Middle Ground, Macroinfauna, Macroepifauna, Offshore oil production, Suspended particulate matter, Microbial biomass, Relative abundance, Species, Diversity.

Benchmark studies on the Eastern Gulf of Mexico Outer Continental Shelf were conducted seasonally to establish baseline information prior to extensive oil and gas development activity. No crude oil-like hydrocarbons were found in sediments, benthic organisms, zooplankton, suspended particulates nor dissolved phases on the Florida shelf. Moreover the abundance and diversity of organisms suggested that these organisms are living in an essentially pristine and natural ecological states, and show no evidence of stress owing to influx of pollutants. Some evidence of hydrocarbon anomalies were found in samples from the Mississippi-Alabama self probably due to drainage from the Mississippi River. A study of tissue pathology revealed only parasites in otherwise normal benthic organisms. Major features affecting the study area were the Mississippi River, the Loop Current and hurricane Eloise. Trace metal (Cd, Cr, Cu, Fe, Ni, Pb and V) concentrations in Eastern Gulf samples were at levels expected for nonpolluted areas. (BLM)  
W78-12328

**ANALYTICAL FRAMEWORK FOR THE DESIGN OF DATA COLLECTION SYSTEMS THAT ARE RESPONSIVE TO THE NEEDS OF PLANNING AND MANAGEMENT OF WATER RESOURCES AND RELATED LAND SYSTEMS.**  
Case Western Reserve Univ., Cleveland, OH. Systems Engineering Div.  
For primary bibliographic entry see Field 6A.  
W78-12388

**MATHEMATICAL MODELS FOR SIMULATING MONTHLY WATER LEVELS AND SALINITIES IN SHALLOW LAKES.**  
University of the Witwatersrand, Johannesburg (South Africa).  
For primary bibliographic entry see Field 2L.  
W78-12411

**SYSTEMS ENGINEERING IN WATER RESOURCES DEVELOPMENT.**  
Technion - Israel Inst. of Tech., Haifa.  
For primary bibliographic entry see Field 6A.  
W78-12420

**WATER RESOURCES MANAGEMENT USING INTEGER PROGRAMMING MODELS.**  
Utah State Univ., Logan. Coll. of Engineering.  
For primary bibliographic entry see Field 5G.  
W78-12540

**MODEL STATE INFORMATION SYSTEM FOR THE SAFE DRINKING WATER PROGRAM. VOLUME I: SUBSYSTEM DESCRIPTION. DEFINITION OF SYSTEM REQUIREMENTS.**  
American Management Systems, Inc., Arlington, VA.  
For primary bibliographic entry see Field 5G.  
W78-12548

**MODEL STATE INFORMATION SYSTEM FOR THE SAFE DRINKING WATER PROGRAM.**

**VOLUME II: EXHIBITS, DEFINITION OF SYSTEMS REQUIREMENTS.**  
American Management Systems, Inc., Arlington, VA.  
For primary bibliographic entry see Field 5G.  
W78-12549

**MODEL STATE INFORMATION SYSTEM FOR THE SAFE DRINKING WATER PROGRAM. VOLUME III: DATA ELEMENT DICTIONARY. DEFINITION OF SYSTEM REQUIREMENTS.**  
American Management Systems, Inc., Arlington, VA.  
For primary bibliographic entry see Field 5G.  
W78-12550

**OUTER CONTINENTAL SHELF OIL AND GAS INFORMATION PROGRAM.**  
Geological Survey, Washington, DC.  
Federal Register, Vol. 43, No. 19. p 3887-90, January 27, 1978.

Descriptors: \*Continental shelf, \*Exploration, \*Geological surveys, \*Oil industry, Oil, Regulation, State governments, Local governments, Industries, Data, Coasts.

These regulations are intended to supplement the procedures contained in Parts 250 and 251 of this Chapter for the submission of oil and gas data and information resulting exploration, development, and production operations on the Outer Continental Shelf to the Director of the United States Geological Survey. This section also establishes procedures for the Director to make certain information available to the governors of affected states and, upon request, to interested local governments, in accordance with the provisions of the federal Freedom of Information Act. Any person engaging in the exploration for, or development and production of, oil and gas on the Outer Continental Shelf is required to make all obtained data from such activities available for inspection by the Oil and Gas Supervisor of the United States Geological Survey. The Director, will then make this information available to affected states and interested local governments by way of a summary report. This summary report shall include: (1) estimates of oil and gas reserves and estimated rates of production; (2) approximations of magnitude and timing of development; (3) methods of transportation to be used; and (4) location of facilities. (Quarles-Florida)  
W78-12555

**THE WORLD REMOTE SENSING BIBLIOGRAPHIC INDEX.**  
Tensor Industries, Inc., Falls Church, VA.  
For primary bibliographic entry see Field 7B.  
W78-12618

**STORAGE-GAGE PRECIPITATION DATA FOR WESTERN UNITED STATES 1974-1975. VOLUME 20.**  
National Climatic Center, Asheville, NC.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 424. Price codes: A03 in paper copy, A01 in microfiche. NOAA-76122002, 1976. 37 p.

Descriptors: \*Weather data, \*United States, \*Precipitation(Atmospheric), \*Arizona, \*California, \*Colorado, \*Idaho, \*Montana, \*Nevada, \*New Mexico, \*Oregon, \*Utah, \*Washington, \*Southwest U.S., \*Rocky Mountain region, \*Data collections, Maps, Stations, Measurement, Weather, Climatic data, Meteorological data, Regional analysis, \*Western United States, Storage gage precipitation.

This storage-gage precipitation data report for the Western United States included data for the period 1974-1975. It contained data on precipitation measurements, station changes, a station index for

## Field 7—RESOURCES DATA

### Group 7C—Evaluation, Processing and Publication

each state, and maps identifying the location of data collection sites in the states. (Froehlich-ISWS)  
W78-12623

**OPTIMIZATION OF LAKE HYDROGRAPHIC SURVEYS.**  
National Swedish Environment Protection Board, Uppsala (Sweden). Limnological Survey. L. Hakanson.  
Water Resources Research, Vol. 14, No. 4, p 545-560, August 1978. 20 fig, 8 tab, 9 ref.

Descriptors: \*Lakes, \*Surveys, \*Bathymetry, \*Mapping, Hydrography, Lake morphology, Optimization, Theoretical analysis, Analytical techniques, Equations, Mathematical models, Limnology, Empirical equations, Hypsographic curves.

Bathymetric maps are the source of most morphometric data used in limnological, hydrological, and sedimentological contexts. The reliability of the morphometric data will depend on the accuracy of the bathymetric map, which in turn will depend on the intensity of the hydrographic survey. The aim of this work was to analyze thoroughly the relationship between intensity of survey, aim of survey, and yield of survey and to deduce a formula which may be used to express these concepts quantitatively so that hydrographic surveys can be executed in an optimal manner. An empirical formula which may be utilized to estimate the length of contour lines of a given bathymetric map from the hypsographic curve also introduced. (Sims-ISWS)  
W78-12624

**FLOOD PLAIN INFORMATION: CORRALITOS CREEK, SANTA CRUZ COUNTY, CALIFORNIA.**

Army Engineer District, San Francisco, CA.  
For primary bibliographic entry see Field 4A.  
W78-12650

**FLOOD PLAIN INFORMATION: LEVISA FORK AND TRIBUTARIES, BUCHANAN COUNTY, VIRGINIA, GRUNDY TO OAKWOOD.**

Army Engineer District, Huntington, WV.  
For primary bibliographic entry see Field 4A.  
W78-12651

**UNSTEADY SOLUTE-TRANSPORT SIMULATION IN STREAMFLOW USING A FINITE-DIFFERENCE MODEL.**  
Geological Survey, Bay St. Louis, MS. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W78-12726

**GROUND-WATER RESOURCES OF ADAMS AND BOWMAN COUNTIES, NORTH DAKOTA.**  
Geological Survey, Bismark, ND. Water Resources Div.  
For primary bibliographic entry see Field 2F.  
W78-12727

**DROUGHT IN CALIFORNIA--WATER-RESOURCES DATA FOR 1977.**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
L. N. Jorgensen, and V. F. Pearce.  
Open-file report 78-613, August 1978. 117 p, 2 fig.

Descriptors: \*California, \*Droughts, \*Streamflow, \*Low flow, \*Water quality, Water shortage, Tidal effects, Estuaries, Saline water intrusion, Sediment discharge, Backwater, Water table, Groundwater, Water levels, Water wells, Hydrologic budget.

The 2-year dry period 1976-77 was the most severe drought in northern California's history, and the quantity and quality of all water-supply sources in the State were affected. This report contains special water-resources data collected by the Geological Survey during 1977. These data include: streamflow at 11 selected stations, comparing the 1977 mean monthly and yearly flow to the period-of-record medians; base-flow measurements at 189 selected sites; water quality at 131 selected sites; ground-water levels in wells and river stages along a 158-mile reach of the Sacramento River; and, finally, graphs showing the effect of tidal action on suspended-sediment concentration at the stream-gaging station on the Sacramento River at Sacramento. (Woodard-USGS)  
W78-12730

**PROGRESS REPORT ON BLACK MESA PROGRAM--1977.**  
Geological Survey, Tucson, AZ. Water Resources Div.  
For primary bibliographic entry see Field 5G.  
W78-12740

**THE HYDROLOGY OF LAKE ROUSSEAU, WEST-CENTRAL FLORIDA.**  
Geological Survey, Tallahassee, FL. Water Resources Div.  
E. R. German.

Water-Resources Investigations 77-126 (open-file map), 1978. 1 sheet, 13 fig, 1 tab, 10 ref.

Descriptors: \*Lakes, \*Impounded waters, \*Hydrology, \*Water quality, \*Lake morphology, Inflow, Streamflow, Groundwater, Water levels, Discharge (Water), Chemical analysis, Water temperature, Maps, Hydrographs, \*Florida, \*Lake Rousseau (Fla), Inglis area (Fla), \*Lake hydrology.

Lake Rousseau, about 4 miles southwest of Inglis, Florida, was formed in 1909 by impoundment of the Withlacoochee River by Inglis Dam, west of Dunnellon, Florida. The lake was to have been part of the Cross-Florida Barge Canal: a lock and channel associated with the presently inactive project were completed in 1969. Lake Rousseau is about 11 miles long, covers about 4,000 acres, and contains about 34,000 acre-feet of water at the normal pool elevation of 27.5 feet above mean sea level. Inflow to the lake is relatively constant and responds slowly to rainfall. The estimated 100-year peak inflow, 10,400 cubic feet per second, is only 19 percent higher than the 100-year high monthly inflow. Water in Lake Rousseau is a calcium-bicarbonate type and is hard. Mean total phosphorus and organic nitrogen concentrations are considerably lower in Lake Rousseau than in north-central Florida lakes which have been considered to be eutrophic by other investigators, however, the lake supports of prolific aquatic plant community. Dissolved-oxygen concentrations near the water surface are occasionally less than 3 mg/liter. (Woodard-USGS)  
W78-12741

**WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1977--VOLUME 1. ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY.**  
Geological Survey, Trenton, NJ. Water Resources Div.  
Water-Data Report NJ-77-1, June 1978. 491 p, 17 fig, 4 tab, 30 ref.

Descriptors: \*New Jersey, \*Hydrologic data, \*Surface waters, \*Groundwater, \*Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, \*Atlantic Slope basins, \*Hudson River to Cape May.

Water resources data for the 1977 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume of the report, Atlantic Slope basins and Hudson River to Cape May, contains discharge records for 66 gaging stations; tide summaries for 7 stations; stage and contents for 15 lakes and reservoirs; water quality for 37 gaging stations, 159 partial-record flow stations, 1 reservoir, and 147 wells; and water levels for 11 observation wells. Also included are 50 crest-stage partial-record stations and 45 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (Woodard-USGS)  
W78-12742

**WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1977--VOLUME 2. DELAWARE RIVER BASIN AND TRIBUTARIES TO DELAWARE BAY.**

Geological Survey, Trenton, NJ. Water Resources Div.  
Water-Data Report NJ-77-2, June 1978. 325 p, 16 fig, 4 tab, 30 ref.

Descriptors: \*New Jersey, \*Hydrologic data, \*Surface waters, \*Groundwater, \*Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume of the report, Delaware River basin and tributaries to Delaware Bay, contains discharge records for 26 gaging stations; tide summaries for 5 stations; stage and contents for 16 lakes and reservoirs; water quality for 17 gaging stations, 94 partial-record flow stations, and 57 wells; and water levels for 3 observation wells. Also included are 27 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (Woodard-USGS)  
W78-12743

**WATER RESOURCES DATA FOR VIRGINIA, WATER YEAR 1977.**  
Geological Survey, Richmond, VA. Water Resources Div.  
Water-Data Report VA-77-1, June 1978. 391 p, 4 fig.

Descriptors: \*Virginia, \*Hydrologic data, \*Surface waters, \*Groundwater, \*Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Virginia consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells and springs. This report contains discharge records for 198 gaging stations, stage only for 1 gaging station, stage and contents for 9 lakes and reservoirs, water quality for 32 gaging stations, and water levels for 49 observation wells. Also included are data for 95 crest-stage partial-record stations. Additional

## ENGINEERING WORKS—Field 8

### Hydraulics—Group 8B

water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia. (Woodard-USGS)  
W78-12744

**WATER RESOURCES DATA FOR MISSISSIPPI, WATER YEAR 1977.**  
Geological Survey, Jackson, MS. Water Resources Div.  
Water-Data Report MS-77-1, June 1978. 409 p, 5 fig.

Descriptors: \*Mississippi, \*Hydrologic data, \*Surface waters, \*Groundwater, \*Water quality, \*Gaging stations, \*Streamflow, \*Flow rates, \*Sediment transport, \*Water analysis, \*Water temperature, \*Chemical analysis, \*Lakes, \*Reservoirs, \*Water wells, \*Water levels, \*Data collections, \*Sites.

Water resources data for the 1977 water year for Mississippi consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels of wells. This report contains discharge records for 85 gaging stations; stage records for 15 of these gaging stations; stage only for 3 gaging stations; contents for 4 lakes; water quality for 25 gaging stations, 2 partial-record stations, and 169 wells; and water levels for 186 observation wells. Also included are data for 138 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Mississippi. (Woodard-USGS)  
W78-12745

**URBAN STORM-WATER DATA MANAGEMENT SYSTEM, BROWARD COUNTY, FLORIDA.**  
Geological Survey, Bay St. Louis, MS. Water Resources Div. and Geological Survey, Miami, FL. Water Resources Div.  
L. D. Wilson, R. A. Miller, and W. H. Doyle, Jr.  
In: Proceedings of the International Symposium on Urban Storm-Water Management, held at University of Kentucky, Lexington, July 24-27, 1978. 6 p, 6 fig, 1 tab, 6 ref.

Descriptors: \*Urban runoff, \*Storm water, \*Model studies, \*Computer models, \*Urban hydrology, \*Water quality, \*Storm runoff, \*Analytical techniques, \*Hydrologic data, \*Input-output analysis, \*Statistical analysis, \*Computer programs, \*FORTRAN, \*Florida.

A data management system was created for handling urban storm-water data collected in Broward and Dade Counties, Florida (one site in Dade County). The system, composed of about 20 Fortran programs, was developed to input data, output tables for publication, calculate discharge and constituent loads and interface to statistical and deterministic model application programs. Statistical interface programs retrieve data from the file and create user-specified parameters for use in SAS76, a comprehensive statistical analysis system (Barr and others, 1976). A deterministic model interface retrieves data for input into an urban storm-water model developed by Dawdy, Schaake, and Alley (1978). (Woodard-USGS)  
W78-12747

**QUALITY AND QUANTITY OF STORM-WATER RUNOFF FROM THREE LAND-USE AREAS, BROWARD COUNTY, FLORIDA.**  
Geological Survey, Miami, FL. Water Resources Div.  
For primary bibliographic entry see Field 5B.

W78-12748

#### DESCRIPTION OF THE ECOREGIONS OF THE UNITED STATES.

Forest Service (USDA), Ogden, UT.  
For primary bibliographic entry see Field 6G.  
W78-12749

**SUMMARY OF METROMEX, VOLUME 2: CAUSES OF PRECIPITATION ANOMALIES.**  
Illinois State Water Survey, Urbana.  
For primary bibliographic entry see Field 2B.  
W78-12830

**ALTERNATIVE POLLUTION CONTROL STRATEGIES: EQUITY, EFFICIENCY AND INFORMATION REQUIREMENTS.**  
Tennessee Univ., Knoxville. Dept. of Economics.  
For primary bibliographic entry see Field 5G.  
W78-12875

**NORTH AMERICAN PROJECT—A STUDY OF U.S. WATER BODIES.**  
Corvallis Environmental Research Lab., OR.  
For primary bibliographic entry see Field 5C.  
W78-12895

**STATISTICAL MODELS AND METHODS FOR RIVERS IN THE SOUTHWEST.**  
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.  
For primary bibliographic entry see Field 2E.  
W78-12925

## 8. ENGINEERING WORKS

### 8A. Structures

**RHODESIA TODAY, 3 A REVIEW OF DAM CONSTRUCTION.**  
Civil Engineering Contractor (Johannesburg) Vol. 10, No. 7, p 34-42, 1976.

Descriptors: \*Dam construction, \*Dam design, \*Rockfill dams, \*Spillways, \*Rhodesia, \*Southern Africa, \*Darwendale dam, \*Mayfair dam.

Rhodesia's money squeeze has caused construction to be restricted to essentials only. This has meant a severe cut-back in dams with major water development projects deferred. The article looks at the situation and at dam construction underway. Special attention is given to the design features of Darwendale Dam which will provide Salisbury with water when Lake McIlwaine no longer fulfills its needs. (So Afr Water Info Ctr)  
W78-12414

**PORTABLE DAMS.**  
Municipal Engineer, Vol. 7, No. 2, p 59, 1976.

Descriptors: \*Dams, \*Portable equipment, \*Synthetic fabrics, \*Equipment description, \*New technique, \*Standing waters, \*South Africa.

A short article describing a portable, self-anchoring dam system consisting of a steel framework covered with a tough membrane of flexible, tailored synthetic fibre, to hold back flowing water in rivers or static water in lakes or canals. Dams are placed at required distance apart and the water in between is pumped out, exposing a cleared section for the work in hand. (So Afr Water Info Ctr)  
W78-12437

**LAING DAM.**  
Municipal Engineer, Vol. 7, No. 4, p 23, 1976. 1 illustr.

Descriptors: Flow regulation, Water supply, Design floods, Modifications, \*South Africa, \*Laing Dam.

In the 30 years that have elapsed since Laing Dam, near East London, was constructed, there have been marked changes in the accepted criteria on the basis of which dams are designed. Confirmation of the need to make provision for much larger floods than were originally expected came in April 1970 when flow over the spillway exceeded that for which the dam had been designed by 150 per cent. After extensive investigations it was decided to install vertical prestressed cables to hold the dam down against the pressure of the maximum probable flood. (So Afr Water Info Ctr)  
W78-12442

**A NEW GIANT ON THE ORANGE RIVER.**  
A. G. Davies.  
Construction in Southern Africa, Johannesburg, Vol. 22, No. 7, p 22-25, 27, 31-33, 1977. 7 plans.

Descriptors: Dams, \*Dam design, \*Dam construction, \*Hydrology, \*Geology, \*Arch dams, \*Silt, \*Spillway gates, \*Dam foundations, \*Diversion structures, \*Concrete construction, \*Hydroelectric power, \*Design data, \*South Africa, \*P. K. Le Roux dam.

Discussion is presented of the design and construction of the project, highlighting the hydrological aspects of the construction, the geology of the dam sites, the design of the dam, giving details of the free overspill, silt outlet, gated spillway, radial joint grouting, cooling of the concrete during construction, foundation grouting and drainage and instrumentation placed in the arches to monitor changes. (So Afr Water Info Ctr)  
W78-12485

**BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY. VOLUME III, ANNEX B: ENGINEERING STUDIES OF WATER DEVELOPMENT PROJECTS.**  
For primary bibliographic entry see Field 6B.  
W78-12770

**FUNDAMENTAL ARMOR MODULE IN BREAKWATER NET LINKED SYSTEM.**  
R. Pey.  
U.S. Patent No. 4,083,190, 6 p, 9 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 969, No. 2, p 438, April 11, 1978.

Descriptors: \*Patents, \*Breakwaters, \*Engineering structures, \*Coastal structures, \*Waves (Water), \*Ocean waves, \*Shore protection.

An improved breakwater network is composed of similarly sized members which may be prefabricated in concrete or other rigid material and transported to a job site to be interconnected with one another to form a breakwater network which is effective to resist wave action and relatively inexpensive in construction and to assemble. Each of the bodies includes a generally triangular configuration having equi-spaced legs extending from the vertexes to interlink in mating relation with corresponding bodies provided with similar legs, the legs being received in recesses provided in the bodies. (Sinha-OEIS)  
W78-12796

### 8B. Hydraulics

**KALMAN FILTER IN OPEN CHANNEL FLOW ESTIMATION.**  
Pittsburgh Univ., PA. Dept. of Civil Engineering.  
C. L. Chiu, and E. O. Izu.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY8, Proceedings Paper 13946, p 1137-1152, August 1978. 9 fig, 19 ref.



## Field 8—ENGINEERING WORKS

### Group 8B—Hydraulics

**Descriptors:** \*Open channels, \*Model studies, \*Open channel flow, Hydraulics, Mannings equation, Equations, Mathematical studies, Mathematical models, Estimating, \*Kalman filter, Open channel hydraulics, Resistance coefficients, Manning formula.

In computing water surface profiles in open channels, uncertainties often arise in selection of resistance coefficients, such as Manning's  $n$ . In this paper the Kalman filtering approach was developed to deal with such uncertainties. This approach combined a mathematical system model and an observation model. The former consists of (1) stochastic nonlinear differential equation governing the steady one-dimensional open channel flow; and (2) one of three possible stochastic differential equations expressing Manning's  $n$  (constant, function of the location of channel cross section, or function of both the location and the water depth). The observation model simply shows the observed water depth as the sum of 'true water depth' and 'error'. The estimation technique was tested for its accuracy in generating estimates of water depth and Manning's  $n$  at several different schemes of sampling or measuring water depths. Results with Kalman filtering were compared with two parallel methods normally used today. (Lee-ISWS)  
W78-12137

**FLUID DYNAMIC LIFT ON A BED PARTICLE.** Canterbury Univ., Christchurch (New Zealand). Dept. of Agricultural Engineering. T. R. H. Davies, and M. F. A. Samad. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY8, Proceedings Paper 13976, p 1171-1182, August 1978. 10 fig, 1 tab, 19 ref.

**Descriptors:** \*Bed load, \*Flow, \*Erosion, Dunes, Rivers, Sedimentation, Sediment transport, Hydraulics, Reynolds number, Mathematical studies, \*Bed forms, Bed movements, Bed ripples, Loose-boundary hydraulics, Hydrodynamic lift, Incipient motion.

Direct measurement of lift forces acting on an exposed sphere at the boundary of a fluid flow showed that the lift force may be negative (i.e., directed toward the boundary) if the grain-size Reynolds number  $R$  is less than about 5. The graphs presented strongly suggest that in a Newtonian fluid the dimensionless lift force is a function only of  $R$ , in which case the results obtained can be expected to apply to exposed grains at the bed of a loose boundary flow if similarity of  $R$  obtains. The onset of negative lift in such a situation as  $R$  decreases through about 5 coincides with well-documented changes in bedform (from dunes to ripples) and in incipient motion conditions. It was suggested that the change of sign of lift force is a significant factor in these behavioral characteristics; physical mechanisms capable of effecting the observed changes were considered in qualitative terms. (Lee-ISWS)  
W78-12138

**EFFECT OF STORMWATER ON STREAM DISSOLVED OXYGEN.** Municipal Environmental Research Lab., OH. For primary bibliographic entry see Field 5B.  
W78-12139

**HORIZONTAL BUOYANT JETS IN QUIESCENT SHALLOW WATER.** Iowa Univ., Iowa City. Inst. of Hydraulics Research. V. Balasubramanian, and S. C. Jain. Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. E34, Proceedings Paper 13943, p 717-730, August 1978. 12 fig, 1 tab, 14 ref, 2 append.

**Descriptors:** \*Heated water, \*Jets, \*Laboratory tests, \*Model studies, Hydraulic models, Temperature, Water temperature, Thermal pollution, Flow, Mixing, Dispersion, Thermal water, Spatial distribution, Shallow water, Hydraulics, Submerged flow, Buoyant jets.

The flow behavior of a single round buoyant jet discharging into a shallow quiescent body of water was investigated experimentally. The temperature distributions were measured in a large test basin for jet densimetric Froude numbers ranging from 5 - 20 and submergence ratios ranging from 2.5 - 7. Empirical relations for the flow-field stability of the near field, the temperature rise in the zone of surface impingement and the water surface area covered by the temperature rise isotherms were proposed. (Sims-ISWS)  
W78-12141

**MAXIMUM NONEROSIVE FURROW IRRIGATION STREAM SIZE.** Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering. For primary bibliographic entry see Field 4D.  
W78-12143

**SIMILARITY OF FREE-VORTEX AT HORIZONTAL INTAKE.** Hydraulics Research Station, Wallingford (England). H. O. Anwar, J. A. Weller, and M. B. Amphlett. Journal of Hydraulic Research, Vol. 16, No. 2, p 96-105, 1978. 8 fig, 14 ref.

**Descriptors:** \*Vortices, \*Flumes, \*Intakes, Reynolds number, Hydraulics, Equations, Mathematical studies, Pipes, Flow, Analysis, Entrainment, \*Free-vortex, Horizontal intake, Air-entraining vortices, Weber number.

An investigation was conducted to study the onset of air-entraining vortices at a horizontal intake, with and without a bellmouthed entry, when the intake was projected into the experimental flume or mounted flush with the side wall. The basic non-dimensional parameters that govern the onset of vortices at a horizontal intake in model and prototype were derived and determined experimentally. The results of measurements were given as a set of curves, which can be used for the design of a vortex-free intake and also for the selection of appropriate model scales. The results of the measurement showed that flow conditions in an air-entraining vortex are not affected by surface tension, and the viscosity of the test fluid when the radial Reynolds number and the Weber number are larger than 30,000 and 10,000 respectively. In this case, the formation of vortices depends largely on circulation, submergence head, and discharge into the intake. It was found that the bellmouth did not improve the performance of the intake, but its performance was improved considerably when the intake with or without bellmouthed entry was flush with the boundary wall. (Lee-ISWS)  
W78-12160

**EFFICIENT PRESSURE SOLUTION FOR CIRCULATION PREDICTION.** Ohio State Univ., Columbus. Dept. of Civil Engineering. K. W. Bedford, and I. S. Rai. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY6, Proceedings Paper 13833, p 899-915, June 1978. 3 fig, 1 tab, 30 ref. OWRT B-036-OHIO(1).

**Descriptors:** \*Forecasting, \*Pressure, \*Circulation, Fluid mechanics, Lakes, Hydrodynamics, Numerical analysis, Oceanography, Water resources, Equations, Mathematical studies, Surface wind shear, Aitken acceleration method, Direct Gaussian Elimination Method.

Two formulations of the rigid-lid, wind-driven lake circulation model were presented. The first formulation results in the standard quasi-steady elliptic pressure equation. The second, used in variable topography applications, is a time splitting formulation resulting in a second-order elliptic pressure equation with coefficients that vary at each time step. The pressure equations are discretized by the finite element method and the quickest equation solver identified as a function of the degree of equation nonlinearity, the time variability of the applied surface wind shear, and permissible computational time step. The equation solvers are standard, readily available, easily programmable, and include optimal successive over relaxation, double sweep successive over relaxation, Aitken acceleration, direct Gaussian elimination with back-substitution, and direct Gaussian elimination with repeated elimination. The conclusion was that for large incremented changes in boundary loadings over the numerical time step, direct elimination results in considerable computation savings. (Lee-ISWS)  
W78-12281

**SOLVING THE PIPE NETWORK ANALYSIS PROBLEM USING OPTIMIZATION TECHNIQUES.** Southern Methodist Univ., Dallas, TX. M. Collins, L. Cooper, R. Helgason, J. Kennington, and L. LeBlanc. Management Science, Vol. 24, No. 7, p 747-760, March 1978. 4 fig, 4 tab, 47 ref. OWRT C-7115 (6223)(1).

**Descriptors:** \*Water distribution (Applied), \*Pipes, \*Networks, \*Analytical techniques, Algorithms, Optimization, Newton-Raphson technique, Non-linear programming, Linear programming, Hydraulic head, Equations, Mathematical models, Systems analysis, Costs.

For over forty years, approximate solutions for the classical pipe network analysis problem have been obtained by direct solution of the nonlinear stationary point conditions. Proposed is a revolutionary new approach involving optimization techniques for solving water distribution network problems. It is shown that the pipe network analysis problem may be described mathematically in terms of a nonlinear convex cost network flow problem. Three mathematical programming algorithms for solving this problem have been coded and are computationally compared with a code using the traditional Newton-Raphson technique. Considered are a Content Model, Co-Content Model, the Frank-Wolfe Method with and without Partan, and the Convex Simplex Method. The computational experience demonstrates that this new approach provides an efficient alternative for solving the pipe network analysis problem. (Bell-Cornell)  
W78-12285

**SOUTH AFRICAN COMPANY INVOLVED IN INTERNATIONAL WATER INJECTION CONSTRUCTION.** Civil Engineering Contractor (Johannesburg), Vol. 10, No. 9, p 49-54, 1976. 1 map.

**Descriptors:** \*Offshore platforms, Oil wells, Oil fields, \*Water injection, \*Arabian Gulf, United Arab Emirates.

A complex in the Arabian Gulf costing in the region of R300 million is being internationally constructed. The name of the game is water injection. It is the equipment for this which an armada is bringing to Umm Shaif for installing offshore in a complexity and size never before attempted. There are few schemes in the whole history of the petroleum industry which have been planned and executed with a more international approach. The scheme will inject a daily 700 000 barrels of water to achieve an oil production of 390 000 barrels a day. Because South Africa is playing an important

role this article is giving the gigantic facts. (So Afr Water Info Ctr)  
W78-12418

**35 KM TUNNEL SYSTEM FOR CAPE WATER SCHEME**, Department of Water Affairs, Pretoria (South Africa).  
For primary bibliographic entry see Field 4A.  
W78-12444

**EFFECT OF STOCHASTIC MODEL CHOICE ON HYDRAULIC DESIGN**, Water Resources Center, Budapest (Hungary).  
I. Bogardi, L. Duckstein, and E. Castano.  
In: Stochastic Processes in Water Resources Engineering, Proceedings, 2nd Intern. IAHR Symp. on Stochastic Hydraulics, Lund Institute of Technology, Sweden, August 1976. Lars Gottschalk, et al. (Eds.), Water Resources Publications, Fort Collins, Colorado, 1977, p 265-292, (Chapter 12), 8 fig, 5 tab, 9 ref.

Descriptors: \*Hydraulic design, \*Effects, \*Stochastic processes, \*Model choice, \*Hydrology, \*Optimization, \*Levees, Methodology, Backwater, Construction costs, Probability, Flood stages, Statistical methods, Economic efficiency, Flood damage, Cost minimization, Uncertainties, Chi-square, Sample likelihoods, Mathematical models, Equations, Systems analysis.

Investigated is the effect of stochastic model choice on the design of hydraulics works. The methodology is illustrated by the design of a flood levee along the confluence reach of a tributary in the Hungarian plain. This levee reach is subject to backwater effect, which depends on (1) the water stage at the confluence point, (2) the water stage at the upstream end of the protected reach of the tributary, (3) the hydraulic model choice for flood routing, and (4) the stochastic model choice for the joint probability density function. The focus herein is on the latter factor. The optimum levee design which minimizes the sum of the construction costs and the expected flood levee losses is characterized by the levee height at the ends of the reach, since the optimum levee profile should follow the backwater curve. The effect on the optimum design of choosing a stochastic model is investigated by using sample data to fit distributions from various families. It is found that choice of stochastic model may substantially influence the decision. The relative importance of sample uncertainty and model uncertainty is then discussed. It is found that a Bayesian composite probability density function provides encouraging results for handling both model and sample uncertainties in hydraulic structure design. (Bell-Cornell)  
W78-12527

**CHOICE OF DISTRIBUTION FUNCTIONS FOR HYDROLOGIC DESIGN**, Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.  
E. Castano, L. Duckstein, and I. Bogardi.  
Water Resources Research, Vol. 14, No. 4, p 643-652, August 1978. 4 fig, 3 tab, 40 eqn, 21 ref, append.

Descriptors: Hydrology, \*Design, \*Decision making, \*Probability, \*Confluence reach, \*Distribution functions, Flood loss, Levees, Annual, Hungary, Methodology, Optimization, Hydraulic models, Uncertainty, Submodels, Economics, Cost minimization, Bivariate statistics, Bayesian framework, Systems analysis, Equations.

The problem of selecting a bivariate probability density function (pdf) for the simultaneous water stages at both ends of a confluence reach is considered. This pdf is used to compute the expected flood losses in the design of a levee for which the total expected yearly cost is minimized. A case

study in Hunary illustrates the methodology throughout the paper. Two model selection procedures are compared: ranking the candidate pdf's by the likelihood of the X2 statistic and ranking them by their sample likelihoods. A composite model consisting of a linear combination of candidate pdf's weighted proportionally to their sample likelihoods is also considered. It is found that the two selection procedures lead to different choices, which in the example represent a significant cost variation. Although the ranking of the distributions reduces the uncertainty by imposing an ordering within the candidate set, a unique pdf does not fully account for the model uncertainty. In this sense, the composite model seem a more reasonable choice, especially if the decisions are based on expected values. (Bell-Cornell)  
W78-12532

**SHOALING OF WAVES UNDER ICE**, Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 2C.  
W78-12641

**INTEGRAL EQUATION FAILURE IN WAVE CALCULATIONS**, New Orleans Univ., LA. Dept. of Physics.  
For primary bibliographic entry see Field 2L.  
W78-12642

**HYDROLOGIC ANALYSIS OF THE U.S. BUREAU OF MINES' UNDERGROUND OIL-SHALE RESEARCH-FACILITY SITE, PICEANCE CREEK BASIN, RIO BLANCO COUNTY, COLORADO**, Geological Survey, Lakewood, CO. Water Resources Div.  
R. H. Dale, and J. B. Weeks.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 267, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 78-28, May 1978. 35 p, 16 fig, 4 tab, 5 ref.

Descriptors: \*Dewatering, \*Shafts(Excavations), \*Mining engineering, \*Oil shales, \*Computer models, Groundwater movement, Planning, Aquifer characteristics, Drilling, Testing, Model studies, Waste disposal, Evaluation, \*Colorado, \*Piceance Creek basin(Colo), Rio Blanco County(Colo).

The U.S. Bureau of Mines plans to develop an underground oil-shale research facility near the center of Piceance Creek basin in Colorado. The oil-shale zone, which is to be penetrated by a shaft, is overlain by 1,400 feet of sedimentary rocks, primarily sandstone and marlstone, consisting of two aquifers separated by a confining layer. Three test holes were drilled by the U.S. Bureau of Mines to obtain samples of the oil shale, and to test the hydraulic properties of the two aquifers. The data collected during construction of the test holes were used to update an existing groundwater-flow computer model. The model was used to estimate the maximum amount of water that would have to be pumped to dewater the shaft during its construction. It is estimated that it would be necessary to pump as much as 3,080 gallons per minute to keep the shaft dry. Disposal of waste water and rock are the principal hydrologic problems associated with constructing the shaft. (Woodard-USGS)  
W78-12732

**FLOW STILLING DEVICE**, Pro-Tech, Inc., Paoli, PA. (Assignee).  
K. W. Martig, Jr.  
U.S. Patent No. 4,081,998, 5 p, 8 fig, 1 ref; Official Gazette of the United States Patent Office, Vol 969, No 1, p 52, April 4, 1978.

Descriptors: \*Patents, \*Flow control, \*Conveyance structures, Conduits, Sewers, Flow measurement, Safety, \*Flow stilling device.

A stilling device is especially useful in large water or sewer pipes of conduits having sufficient flow to render it unsafe to venture further than an overhead access opening to sample the flowing liquid or measure its flow rate. The stilling device of this invention is tubular T-shape. The base of the T comprises telescoping sections adapted to be secured together at given extended length. Openings through one side of the T base in a direction perpendicular to the plane of the T facilitate equalization of liquid level inside with the surrounding level when immersed in a water or sewer pipe or conduit. The cross-bar of the T aids retention of the stilling device in place. (Sinha - OEIS)  
W78-12784

**DRAG REDUCTION OF DEGRADED AND BLENDED POLYMER SOLUTIONS**, David W. Taylor Naval Ship Research and Development Center, Bethesda, MD. Ship Performance Dept.  
T. T. Huang, and N. Santelli.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A028 214, Price codes: A03 in paper copy, A01 in microfiche. Report 4311, December 1975. 41 p, 8 fig, 2 tab, 17 ref.

Descriptors: \*Drag, \*Polymers, \*Pipe flow, Laboratory tests, Mathematical models, Chemicals, Organic compounds, Solutes, Aqueous solutions, Energy, Degradation(Decomposition), Hydraulics, \*Drag reduction.

A 3.18-cm-ID smooth turbulent flow pipe facility was utilized to measure the drag-reduction characteristics of three polymer solutions: Polyoxy WSR-301, Separan 237, and Magnifloc 835A. A rotating disk was used to degrade the polymer solutions, and accurate control was maintained over the energy used to agitate (shear degrade) the solutions. Quantitative data were obtained on the relationship between degradation and drag reduction for these three polymers and for blended solutions prepared by mixing two different polymers in various proportions. A length scale correlation of polymeric drag reduction appears to be self-consistent for the wide range of concentrations, shear stresses, and degrees of degradation of Polyoxy solutions investigated. Time scale correlation of polymeric drag reduction was found to be questionable. The drag reduction of the blended solutions was found to follow a simple addition rule. (Sims-ISWS)  
W78-12831

**FLUID FORCES ON OSCILLATING CYLINDERS**, Naval Postgraduate School, Monterey, CA. Dept. of Mechanical Engineering.  
T. Sarpkaya.  
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 104, No. WW4, Proceedings Paper 13941, p 275-290, August 1978. 8 fig, 3 tab, 17 ref, 1 append.

Descriptors: \*Flow resistance, \*Hydraulic structures, \*Laboratory tests, \*Loads(Forces), Fluid mechanics, Vibrations, Uniform flow, Flow, Dynamics, Theoretical analysis, Analysis, Drag, Methodology, Resonance, Oscillating cylinders, Forced vibrations, Cylinders, Transverse force.

The paper presented the results of an experimental and analytical investigation of the forced oscillations of a circular cylinder in uniform flow. The transverse force was decomposed into two components, and the appropriate force-transfer coefficients were determined experimentally through the use of a Fourier averaging technique. The results then were incorporated into the equation of

## Field 8—ENGINEERING WORKS

### Group 8B—Hydraulics

motion to predict the dynamic response of elastically-mounted cylinders. The numerical predictions were found to be in good agreement with those obtained experimentally. The use of the experimentally obtained drag and inertia coefficients for the transverse force together with a numerical integration scheme accurately predicts the dynamic response of a self-excited cylinder in the synchronization region. A parametric study of the separate and combined effects of material damping, mass ratio, and the response parameter showed that the maximum response of the cylinder is governed by the response parameter alone only for  $S$  sub  $G$  (damping ratio/response parameter) values larger than about unity. Additional data and calculations are needed to explore the effect of these parameters further. It appears, on the basis of somewhat limited observations, that a self-excited system may exhibit unstable oscillations for certain combinations of the damping and mass ratios. (Humphreys-ISWS) W78-12846

#### VERTICAL CYLINDERS OF ARBITRARY SECTION IN WAVES,

British Columbia Univ., Vancouver. Dept. of Civil Engineering.  
M. de St. Q. Isaacson.  
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 104, No. WW4, Proceedings Paper 13973, p 309-324, August 1978. 7 fig, 1 tab, 20 ref, 2 append.

Descriptors: \*Hydraulic structures, \*Waves(Water), \*Coastal engineering, \*Loads(Forces), \*Mathematical models, Ocean waves, Model studies, Offshore platforms, Hydrodynamics, Drag, Theoretical analysis, Analytical techniques, Equations, Numerical analysis, Energy, Mathematical studies, Wave energy, Cylinders.

The wave interaction with large vertical cylinders of arbitrary section extending from the seabed or deep water and piercing the free surface was considered. A method was developed for the efficient computation of the wave loads on such cylinders. There is a considerable economy of effort, both in the complexity of programming as well as in computer time and storage requirements, when the method outlined is applicable and is adopted in place of a more general one used for bodies of arbitrary geometry. Comparisons of the present numerical method were made with previous analytical, numerical, and experimental results, and good agreement was obtained in all cases. As examples of the program's application, results were presented for the forces on an isolated circular cylinder, neighboring circular cylinders, and a square caisson at arbitrary orientation to the incident wave direction. (Humphreys-ISWS) W78-12847

#### FRICTION COEFFICIENT VARIATION WITH FLOW IN AN URBAN STREAM,

Severn-Trent Water Authority, Birmingham (England).  
D. Butler, S. P. Rock, and J. R. West.  
Journal of the Institution of Water Engineers and Scientists, Vol. 32, No. 3, p 227-232, May 1978. 6 fig, 5 ref.

Descriptors: \*Open channel flow, \*On-site tests, \*Roughness coefficient, \*Hydraulics, Mannings equation, Discharge(Water), Velocity, Measurement, Roughness(Hydraulic), Water conveyance, Streamflow, Natural channels, Data collections, On-site data collections, Foreign research, \*England, Urban streams.

Three reaches of an urban stream were surveyed during low and medium flows. Velocity, level, and channel cross section data were used to investigate the variation of Manning's  $n$  with flow for each reach. The magnitude of  $n$  for both lined and unlined reaches at medium flows was within the

ranges given in the references quoted in this paper. For low flows, the magnitude of  $n$  increased by a factor of two. In unlined channels it was found that reaches should be selected carefully if representative data was to be acquired. Further work is required on these reaches to extend the data to cover higher flows. Similar studies in a range of channels would provide engineers with a firmer basis for design work. (Humphreys-ISWS) W78-12863

### 8C. Hydraulic Machinery

#### LIQUOR REMOVAL FROM LAGOON SURFACES - USING FLOATING TAKE OFF LINE WITH COMPENSATION FOR LEVEL CHANGES.

German Patent DS 2406-857. Issued June 29, 1978. Derwent German Patents Abstracts, Vol. A, No. 27, p 3, August, 1978.

Descriptors: \*Sewage lagoons, \*Intakes, \*Floats, \*Water levels, \*Patents, Pipes, Inflow, Design data, Equipment, Floating, Waste water treatment, Municipal wastes.

A floating decantation apparatus which automatically adjusts to the liquid level in a waste water treatment lagoon has been patented. Floats mounted on an intake pipe maintain the liquid decantation orifice just below the surface of the liquid. The edge of the intake pipe lies behind a plane which is perpendicular to the influent source; this perpendicular plane also intersects the axis about which the intake orifice turns. As the level of liquid in the tank changes, the intake pipe inclines to compensate for the new level and maintains the inlet mouth below the surface as it turns. A constant volume of effluent is withdrawn from the lagoon by the apparatus, even in the presence of large liquid level fluctuations. (Lisk-FIRL) W78-12195

#### THE YEOVILLE PUMP STATION A VARIABLE SPEED PUMPING INSTALLATION,

J. W. Clayton.  
South African Mechanical Engineer (Johannesburg) Vol 27, No 5, p 151-156, 1977. 3 fig.

Descriptors: \*Pumping plants, \*Pumping stations, Noise, Pumps, Power requirements, Automatic instrumentation, Water supply development, Water users, Plant modifications, Cities, Urban renewal, Yeoville pump station, Johannesburg, \*South Africa.

The problem of supplying water to rapidly expanding and densely populated areas like Berea and Hillbrow through existing mains, with greatest efficiency and overall economy, has been the one that has taxed the Johannesburg City Engineer's Department. This paper describes the installation chosen and how the problem was solved. Variable speed horizontal split casing pumps were used with commutator motor drives. The speed of these and the number in operation is controlled by balancing the output from a discharge pressure transducer against the tachogenerator fitted to the pumpset and the present required head potentiometer. Flow, pressure and reservoir level are recorded on three-day charts and a typical 24h cycle is shown. (So Afr Water Info Ctr) W78-12401

#### AIRBORNE NOISE OF PUMPING PLANT,

P. W. Lightfoot.  
South African Mechanical Engineer (Johannesburg) Vol. 27, No. 5, p 144-150, 1977. 6 fig, 9 ref, 2 tab.

Descriptors: \*Pumping plants, \*Pumps, Noise, Legislation, Environmental impairment, Cost effectiveness, South Africa.

In recent years, increasing attention has been given by manufacturers to the measurement and suppression of airborne and structure-borne noise produced by pumping plant. This interest, shared by customers who increasingly specify maximum noise levels for pumps in water and sewage works, petrochemical plants and power stations etc, stems from the increasing awareness of the harmful effect that noise has on the environment we live and work in, and should be seen against the background of increasing legislation to reduce noise. Manufacturers normally faced with making a compromise between several conflicting factors have, in a cost-conscious economy, steadily increased the specific output of their pumps by raising speeds, which has in turn tended to elevate noise levels. The paper describes the noise measuring procedures used by a leading British pump manufacturer. Major sources of noise generation both within the manufacturers and the end user control, are identified and means of reducing or eradicating them briefly discussed. Dynamic sound patterns produced by pumps running at part load conditions are recorded, showing that mean level noise metering is inadequate to quantify the disturbing and irritating nature of these sounds. Experimental information obtained over a period of years is collated in order to derive empirical formulae to estimate pump total and octave band sound pressure levels. (So Afr Water Info Ctr) W78-12402

#### PLUGGING IN TO THE BIG DYNAMO, Council for Scientific and Industrial Research Pretoria (South Africa).

For primary bibliographic entry see Field 3E. W78-12445

#### PUMPING FOR WATER SUPPLY,

J. L. Gardiner.  
South African Mechanical Engineer, Johannesburg, Vol 27, No 4, p 95-101, 1977.

Descriptors: \*Potable water, \*Pumping plants, \*Pumping stations, Hydraulic head, Service reservoirs, \*Water supply, Hydraulic gradient, Rand Water Board, Vaal River, Johannesburg, Pretoria, \*South Africa.

In order to meet the continuous demands of its consumers, the water supply authority has to maintain a supply authority at a head generally above the source of water. The pumping system in many cases involves long pipelines and consequently marked friction head variations with changes in the pumping rate. To meet the requirements the type and arrangement of pumps demands careful consideration while sustained high efficiency is of great importance. The paper describes the problems involved and the selection of types and arrangements of pumping plant and of drives to meet the requirements. (So Afr Water Info Ctr) W78-12448

#### CONCRETE VOLUTE PUMPS IN SOUTH AFRICA,

A. H. Laird.  
South African Mechanical Engineer, Johannesburg, Vol 27, No 4, p 102-106, 1977.

Descriptors: \*Concrete volute pumps, \*Electric powerplants, Camden power station, \*South Africa, Escom.

As the size of central power station low head circulating water pumps increased, manufacturers found it increasingly difficult to provide foundry and machine shop capacity to make the larger units - particularly if they were to be made in South Africa. It is therefore natural that the larger components should be built in situ in concrete. The paper gives the history of the building of concrete volute pumps and highlights some of the problems encountered. Construction methods are covered through photographs. (So Afr Water Info Ctr)



W78-12449

**RECENT DEVELOPMENTS AND OPERATING EXPERIENCE WITH BOILER FEED PUMPS FOR LARGE CENTRAL POWER PLANTS.** J.D. Barrie, and J.F. Hood. South African Mechanical Engineer, Johannesburg, Vol 27, No 4, p 112-118, 1977. 3 refs, 11 fig, 2 tab.

**Descriptors:** \*Boiler feedwater, \*Boilers, \*Steam generators, \*Pumps, \*Pumping plants, \*Sealing, \*Powerplants, \*Power generation, \*Equipment description, \*Couplings, \*Impellers, \*South Africa.

Summarises recent operating experience on boiler feed pumps for 500 MW and 660MW generators reviews the specific, related development work which has been carried out since the machines were first installed. Both operating experience and development work are correlated to illustrate their influence on current design practice. In particular, the aspects which contribute significantly to pump reliability are examined, including factors affecting impeller life, rotating element and bearing design and the selection of pump couplings and seals. Current analytical methods used in the design and commissioning of pumps are described. (So Afr Water Info Ctr) W78-12450

#### PUMPS IN NUCLEAR POWER STATIONS,

G.C. Siegers, and M. Wiese. South African Mechanical Engineer, Johannesburg, Vol 27, No 4, p 119-124, 1977. 7 fig.

**Descriptors:** \*Power generation, \*Nuclear power plants, \*Nuclear reactors, \*Pumps, \*Sealed cooling system, \*Safety measure, \*Steam, \*Operation and maintenance, \*Impellers, \*South Africa.

The recent development of nuclear power stations has created very special problems for pump manufacturers. Not only are the block capacities of a nuclear power station far greater than those of a conventional fossil fired generating plant, but also because of other complex environmental and technical factors the problems facing the pump engineer are totally different from the conventional ones. The article deals with the various pump duties required in a nuclear generating plant, and the special requirements involved. It must be obvious, that in the limited scope of this article the subject can only be discussed in general terms, and relatively superficially. (So Afr Water Info Ctr) W78-12451

#### STEENBRAS HYDRO-ELECTRIC SCHEME.

Power and Plant in Southern Africa, August, 1977, p 26-30, 4 diagrams.

**Descriptors:** \*Hydroelectric power, \*Pumped storage, \*Tunneling, \*Dams, \*Steenbras hydroelectric scheme, \*South Africa.

Progress on the huge R40 million Steenbras pumped storage hydroelectric project is described. Murray and Stewart are the main contractors, with major sub-contractors RUC Mining and Contracting and Savage & Lovemore, on civil work on the project. This is valued, with escalation, at some R20 million. The article describes the Power station shafts, machine hall and annexes, the steel pipework, tunneling, control works and reservoir and key dates. (So Afr Water Info Ctr) W78-12480

**COMPREHENSIVE BASIN STUDY, RED RIVER BELOW DENISON DAM, ARKANSAS, LOUISIANA, OKLAHOMA, TEXAS. VOL. 5, APP. VIII: MINERAL RESOURCES AND MINERAL INDUSTRY: APP. IX: ARCHEOLOGICAL, HISTORICAL AND NATURAL RESOURCES: APP. X: HYDROELECTRIC POWER.** For primary bibliographic entry see Field 6B.

W78-12764

**BIG BLACK RIVER, MISSISSIPPI: COMPREHENSIVE BASIN STUDY. VOL. V, AN. H: HYDROELECTRIC POWER: AN. I: ROLE OF THE STATE OF MISSISSIPPI IN THE PLANNING & DEVELOPMENT OF THE WATER AND RELATED LAND RESOURCES: AN. J: TRANSCRIPTS OF PUBLIC HEARINGS.** For primary bibliographic entry see Field 6B. W78-12772

**CONTROL VALVE AND SPEED ADJUSTMENT FOR WATER DRIVE IRRIGATION SYSTEM.** Heinzman Engineering, Inc., Grand Island, NE. (Assignee). For primary bibliographic entry see Field 3F. W78-12774

**DRAGHEAD FOR SUCTION DREDGER.** Bos Kalis Westminster Group N.V., Slidrecht (Netherlands). (Assignee). J.F.R. Andrae. U.S. Patent No. 4,083,132, 5 p, 6 fig, 14 ref; Official Gazette of the United States Patent Office, Vol 969, No 2, p 419, April 11, 1978.

**Descriptors:** \*Patents, \*Dredging, \*Channel improvement, \*Excavation, \*Jets, \*Equipment, \*Slurries, \*Suction dredger, \*Draghead.

A method and a draghead to be used is described for sucking a slurry of earth and transport water by means of a trailing suction dredger. The draghead includes at least one cutter for loosening the earth and water guiding means is provided to guide the transport water to the suction line in a powerful jet substantially parallel to and along the top edge of the cutter. With such method and such a draghead a considerably higher concentration of solid material in the sucked slurry is obtained. (Sinha - OEIS) W78-12792

**SWINGABLE WATER AND SLUSH TUBE ASSEMBLY FOR SUCTION DREDGERS.** Ballast-Nedam Groep N.V., Amstelveen (Netherlands). (Assignee). C.J. Ravesteyn, J. de Koning, and T.A. Wolters. U.S. Patents No. 4,083,133, 8 p, 20 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 969, No 2, p 419, April 11, 1978.

**Descriptors:** \*Patent, \*Dredging, \*Channel improvement, \*Excavation, \*Slurries, \*Equipment, \*Suction dredgers, \*Slush tube.

In a suction dredger, the connection between the water tube flange and the water duct flange is more reliable in operation, if the slush tube is adapted to turn by means of a rotary gland with respect to the slush tube flange to be rigidly coupled with the floating body, with the slush tube flange being connected through an arm with a water tube piece, while the water tube piece is connected through a flexible tubing with the water tube. (Sinha - OEIS) W78-12793

**SUCTION HEAD FOR DREDGERS.** Anglo Dutch Dredging Co. Ltd., Beaconsfield (England); and Amsterdamse Ballast Bagger en Grond (Netherlands). (Assignee). K. Oterdoom. U.S. Patent No. 4,083,134, 4 p, 12 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 969, No 2, p 419-420, April 11, 1978.

**Descriptors:** \*Patents, \*Dredging, \*Channel improvement, \*Excavation, \*Equipment, \*Suction dredger.

The object of the invention is to minimize the energy required for the displacement of the suction head and to ensure that even compact soil is sucked up to an efficient extent. For this purpose the roller is arranged inside the suction chamber, is substantially closed at its head faces, as suction openings being distributed in the circumferential direction across the contact surface. With the trailing dredger embodying the invention the compact soil is agitated by the discontinuous contact surface of the roller, after which it can be readily sucked up across the roller allowing the flow to pass. The discontinuous contact surface locally exerts mechanical forces on the ground, which loosen the soil and the discontinuous suction openings produce continuous variations of the flow pattern, so that a high erosive effect of the ground is obtained. (Sinha - OEIS) W78-12794

**FLEXIBLE CONNECTING ARRANGEMENT FOR SUCTION DREDGERS.** Ballast-Nedam Groep N.V., Amstelveen (Netherlands); and Amsterdamse Ballast Bagger en Grond, b.v., Nieuwegein (Netherlands). (Assignee). T. van den Brink, and T.A. Wolters. U.S. Patent No. 4,083,135, 11 p, 19 fig, 12 ref; Official Gazette of the United States Patent Office, Vol 969, No 2, p 420, April 11, 1978.

**Descriptors:** \*Patents, \*Dredging, \*Channel improvement, \*Excavation, \*Equipment, \*Flexibility, \*Suction dredgers, \*Flexible joints.

In order to avoid damage of the additional ducts at the area of the pivotal joint, the known suction dredger is improved by passing at least one flexible duct for causing the additional ducts arranged at the side of the pipe sections to communicate with one another across the cardan joint. The flexible duct comprises a hose extending through coupling means and at least one hinge part of the universal joint. (Sinha-OEIS) W78-12795

## 8D. Soil Mechanics

**NEW ASPECTS OF SOIL FRACTURING IN CLAY.** Kentucky Univ., Lexington. K.R. Massarsch. Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol. 104, No. GT8, Proceedings Paper 13961, p 1109-1123, August 1978. 5 fig, 2 tab, 43 ref, 2 append.

**Descriptors:** \*Clays, \*Fractures(Geologic), \*Hydrostatic pressure, \*Oil wells, \*Dams, \*Soil properties, \*Permeability, \*Pore pressure, \*Piles(Foundations), \*Grouting, \*Piezometers, \*Engineering, \*Civil engineering, \*Hydraulic fracturing, \*Sand drains, \*Pile driving.

A theoretical analysis using cavity expansion theory suggested that soil fracturing can occur within the plastic zone during expansion of a cavity in clay. Results from pore pressure measurements during pile driving and hydraulic fracturing tests supported these theoretical conclusions. Practical consequences of soil fracturing were considered with respect to pile driving in clay, the efficiency of driven sand drains, as well as field permeability tests. An analysis of the hydraulic fracturing tests for determination of in-situ stresses indicated that, in almost all cohesive soils, fracturing is likely to occur along vertical planes in both normally and over-consolidated clays. (Sims-LSWS) W78-12161

**GOING UNDERGROUND SAVES ON COSTS.** A.B. Davis. South African Tunnelling, Johannesburg, Vol. 2, No. 2, p 6-9, 1977. 2 ref, 1 tab, 2 diag.

## Field 8—ENGINEERING WORKS

### Group 8D—Soil Mechanics

**Descriptors:** \*Tunnel construction, \*Sewerage, Flow augmentation, Tunnel design, City planning, Cost reduction, Tunnel linings, Sandstones, Cost escalation, Poer requirements, Hillary tunnel, Umhlutuzana tunnel, South Africa.

The planning and design of the Hillary and Umhlutuzana Sewerage Tunnels is described. In his summing-up, the author points out that the additional capital cost of tunnelling is rapidly offset when the additional operating costs of any alternative pumping scheme are taken into consideration. (So Afr Water Info Ctr) W78-12497

#### SEALING EARTH DAMS.

For primary bibliographic entry see Field 8G. W78-12512

**EFFECT OF STOCHASTIC MODEL CHOICE ON HYDRAULIC DESIGN,** Water Resources Center, Budapest (Hungary). For primary bibliographic entry see Field 8B. W78-12527

**CHOICE OF DISTRIBUTION FUNCTIONS FOR HYDROLOGIC DESIGN,** Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering. For primary bibliographic entry see Field 8B. W78-12552

**CLASSIFICATION AND ENGINEERING PROPERTIES OF DREDGED MATERIAL,** Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab. For primary bibliographic entry see Field 8G. W78-12621

**FEASIBILITY STUDY OF GENERAL CRUST MANAGEMENT AS A TECHNIQUE FOR INCREASING CAPACITY OF DREDGED MATERIAL CONTAINMENT AREAS,** Texas A and M Research Foundation, College Station. K. W. Brown, and L. J. Thompson. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 509, Price codes: A11 in paper copy, A01 in microfiche. Technical Report D-77-17, October 1977. 223 p, 121 fig, 11 tab, 4 append. DACW39-75-C-0120.

**Descriptors:** \*Dredging, \*Moisture content, \*Feasibility studies, Silts, Feasibility, Moisture, Ditches, Materials, Meteorological data, Evaporation, Drying, Rainfall, Weirs, \*Dredged material, \*Crust management, Containment area, Capacity, Evaporative drying, Small dredge, Outflow weir.

The influence of meteorological conditions on the physical, chemical, and mineralogical properties of fine-grained dredged material on the formation of crusts resulting from evaporative drying in confinement areas was evaluated. After decantation, the moisture content of the surface layer was equivalent to about 2.5 times the liquid limit. Evaporation of moisture during the first stage of drying was nearly the same as that from an open pan until the moisture content decreased to about 1.8 times the liquid limit. After this, drying proceeded at a rate dependent on the transport of moisture to the surface. As the material desiccated, surface cracks opened. The volume shrinkage was equivalent to the volume of water evaporated as the crust formed, and evidence was given that the volume change was irreversible. Rainfall was shed from the crust and drained into the cracks, from which it ran off if channels were provided to the outflow weir. Management practices, including stirring and the removal of a thin layer of crust, produced only a small increase in evaporation rate for a few days. Systems were

developed to dig drainage ditches in the confinements and to remove the consolidated crusts. (Roberts-LSWS) W78-12622

### 8E. Rock Mechanics and Geology

**PROBLEMS APLENTY ON EXPLORATORY CONTRACT.** South African Tunnelling, Johannesburg, Vol. 2, No. 2, p 11, 13, 1977.

**Descriptors:** \*Adits, Pumped storage, Hydroelectric power, Fissures, Exploration, Monitoring equipment, \*Rock excavation, Elandsberg scheme, South Africa.

Poor ground conditions encountered during the driving of a 440m exploratory adit at the site of the proposed Elandsberg Pumped Storage Scheme delayed tunnelling operations and required elaborate support measures. An extensive drilling and geotechnical programme accompanied the exploratory tunnelling. (So Afr Water Info Ctr) W78-12498

**EXPLORATION FOR ROCK ENGINEERING.** Construction in South Africa (Johannesburg) Vol 5, No 11, p 4-9 Supplement, 1976. 1 tab.

**Descriptors:** \*Exploration, \*Rock excavation, Pumped storage, Tunneling, Tunnel design, South Africa, Elandsberg pumped storage scheme, Drakensberg pumped storage scheme, Ruacana Hydropower scheme.

Held in Johannesburg during 1976 was the symposium on 'Exploration for Rock Engineering'. The purpose of the meeting was to identify the engineering parameters which control the design and construction of excavations in rock masses and over 40 papers were presented by both local and overseas experts. A special feature of the symposium was the presentation of several detailed South African case histories and these are reviewed in this article. Special mention is made of the Elandsberg and Drakensberg pumped storage schemes, while the Ruacana Hydro-power scheme is also discussed. (So Afr Water Info Ctr) W78-12510

### 8F. Concrete

**INVESTIGATION OF THE RESISTANCE OF FRESHLY INJECTED GROUT TO EROSION AND DILUTION BY FLOWING WATER,** Army Waterways Experiment Station, Vicksburg, MS. Concrete Lab. For primary bibliographic entry see Field 8G. W78-12169

**DURABILITY OF ASBESTOS-CEMENT PIPES IN LIQUID CORROSIVE MEDIA,** For primary bibliographic entry see Field 8G. W78-12466

**PRELOAD DESIGNED WATER RESERVOIRS IN BOKSBURG.** For primary bibliographic entry see Field 8G. W78-12468

**WATER TOWER FOR KURGERSDÖRP (IN AFRICANS).** Construction in Southern Africa, Johannesburg, Vol 22, No 6, p 25, 27, 31, 1977.

**Descriptors:** \*Water supply, \*Water towers, Potable water, Reservoirs, Prefabricated units, \*Precast concrete, Engineering structures, \*South Africa.

The outstanding characteristic of the design of the Krugersdorp city council's new water tower is the use of heavy scaffolding. Shuttering is being completely eliminated during its construction, due to the use of precast and prestressed concrete. Details of the design and construction is given. (So Afr Water Info Ctr) W78-12481

**THE CRACKING OF EXPOSED CONCRETE PIPES: CAUSES AND REMEDIES,** D. J. Stern. Municipal Administration and Engineering, Vol 42, No 505, p 57-73, 1977. 31 refs, 8 diagrams, 2 fig, 3 tab.

**Descriptors:** \*Concrete pipes, \*Thermal cracking, Reinforcement, Curing, Design standards, Temperature effect, Climatic factors, Thermal stress, Strains, Flexibility, Hydration, Shrinking, Pipe joints, Failure, Prevention, Condensation, Waterproofing, Thermal expansion, Thermal insulation, South Africa.

The article contains an assessment of damage to exposed concrete pipes caused by ambient temperature variations and subsequent movements, strains and stresses; an appraisal of means of preventing thermal cracking; and description of occurrences and magnitudes of cracks; and it discusses the necessity for flexible joints and for improvement by insulating the pipeline, and gives a description of insulating materials. (So Afr Water Info Ctr) W78-12483

**CRACKING ON THE EXPOSED CONCRETE PIPELINE OF THE DIEPSLOOT OUTFALL SEWER, JOHANNESBURG: FIELD INVESTIGATIONS AND INTERPRETATIONS,** M. G. Alexander. Municipal Administration and Engineering, (Johannesburg), Vol 43, No 502, p 6, 9, 11-13, 15, 1977, 6 fig.

**Descriptors:** \*Concrete pipes, \*Thermal cracking, \*Sewers, Field tests, Distribution pattern, Temperature measurement, Strain measurement, Diurnal variations, Watertight, Seasonal variations, Stress analysis, \*Thermal expansion, Thermal insulation, Fibre glass, Polyurethane, South Africa.

The causes of the cracking of exposed concrete pipes on the Diepsloot outfall sewer pipe bridges at Johannesburg. Thermal strain measurements showed that the cracking was caused by thermal bending set up by the difference in temperature between the inner and outer surfaces of the pipes. Experiments conducted on discrete insulated pipes showed that cracking could be controlled or arrested. Important conclusions for the design of exposed concrete pipes yielded by the experimental measuring programme are reached. (So Afr Water Info Ctr) W78-12486

**CORROSION RESISTANCE AND DURABILITY OF ASBESTOS-CEMENT PIPES.** For primary bibliographic entry see Field 8G. W78-12496

### 8G. Materials

**CLEANING RAKE ARRANGEMENT FOR A DRAIN CHANNEL GRID - IS OF LOW, STABLE CONSTRUCTION AND SUITABLE FOR GRIDS WITH STRAIGHT BARS.** German Patent DS 2608-774. Issued May 24, 1978. Derwent German Patents Abstracts, Vol. A, No. 22, p 3, July, 1978.

**Descriptors:** \*Cleaning, \*Sewers, \*Drains, \*Patents, \*Hydraulic equipment, Sanitary en-

gineering, Sewerage, Design data, Dredging, Channels, Bearings, Equipment, Waste water treatment, Municipal wastes.

A cleaning rake for clearing sewer gratings is suitable for sewer grids with straight bars. The rake apparatus has teeth which slant about a horizontal axis and are attached to a rake arm unit which also pivots about a horizontal axis. Vertical motion of the rake arm is provided by a drive mechanism on the underwater side of the sewer grate. The arm assembly is mounted with its pivot shaft located along a curved guide track, forming a two-armed lever. The apparatus is driven by a continuous chain containing fixed sprockets which are located along the guide track and connected to the rake arm. The arm is attached to the side of the pivot shaft by a swinging bearing and to the free end of a swinging support. The cleaning rake apparatus can be moved to an inoperative position, a cleaning mode, and a horizontal discharge position for disposing of the materials to a collection system. (Lisk-FIRL) W78-12121

#### LOCATING DRAINAGE SYSTEMS BY MAGNETOMETER SURVEYS

Toledo Univ., OH. Dept. of Geology. L. C. Ruedisili, and S. M. Logan. Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR3, Proceedings Paper 13996, p 261-273, Sept. 1978. 7 fig, 14 ref, 2 append.

Descriptors: \*Subsurface drains, \*Magnetic studies, \*Drainage systems, \*Pipes, Surveys, Locating, Equipment, Instrumentation, Irrigation, Clay pipes, Plastic pipes, Concrete pipes, Remote sensing, Agriculture, Magnetometers.

The feasibility of using a portable, proton precession, ground magnetometer in the location of subsurface drainage systems was analyzed. Seasonal (fall, winter and spring) surveys of a field drained by clay tile and plastic (PVC) pipe and of a specially constructed test plot on agricultural land were presented. Magnetic anomalies over the drainage lines resulting from the contrast between the drain material, the void in the drain, and the surrounding soil were identified. This magnetic contrast was not affected by the different seasons or the moisture content of the soils. Developed methodology for magnetic location of drains showed that this technique is inexpensive after the initial machine purchase, it is relatively quick, it can be used with or without crop cover, it can be used in any season other than winter, and it requires only minimum manpower and limited technical skills by the magnetometer operator and data interpreter. (Sims-ISWS) W78-12142

#### INVESTIGATION OF THE RESISTANCE OF FRESHLY INJECTED GROUT TO EROSION AND DILUTION BY FLOWING WATER

Army Waterways Experiment Station, Vicksburg, MS. Concrete Lab. D. M. Walley.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A026 260, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper C-76-4, June 1976. 32 p, 8 fig, 4 tab, 4 ref.

Descriptors: \*Materials testing, \*Open channel flow, \*Cement grouting, \*Erosion rates, Erosion, Laboratory tests, Velocity, Viscosity, Cements, Bentonite, \*Grouts, Admixtures, Time of set.

The relative resistance of 35 grout formulations to the effects of erosion and dilution by flowing water with a velocity of 0.3 fps or more was determined by a series of height-of-grout measurements conducted at fixed intervals along the transparent side of a flow channel model. Grout retention in the channel was determined immediately after in-

jection in the flowing water and after 1 or 2 hr of additional water flow. Grouts that were more resistant to the effects of flowing water than other grouts tested were identified, and the materials and physical properties contributing to their increased resistance were discussed. (Adams-ISWS) W78-12169

#### EVAPORATION: SOME PROBLEMS AND THEIR SOLUTIONS

For primary bibliographic entry see Field 3E. W78-12458

#### DURABILITY OF ASBESTOS-CEMENT PIPES IN LIQUID CORROSIVE MEDIA

S. Barshlomo. Municipal Engineer, Vol 8, No 4, p 11-15, 1977. 8 ref, 1 fig, 1 graph.

Descriptors: \*Durability, \*Asbestos cement pipes, \*Corrosive liquids, Potable water, Sewerage, Water supply, \*Corrosion resistance, Acids, Hydrogen sulphide, Carbon dioxide, Coatings, Sulphate, Chloride, South Africa.

One of the important arguments for the application of asbestos-cement pipes, for carrying both potable and sewage, is their high resistance to corrosive media encountered in practice.

In fact, is one of the reasons for the enormous development the asbestos-cement industry has experienced during the last 15 years: the increase in range of nominal diameters, from 1,000 mm to 2,500 mm, in which asbestos-cement pipes are presently produced and applied. Describes the use of asbestos-cement pipes for stormwater drainage, high corrosion resistance and the effects of aggressive substances on asbestos-cement pipes. (So Afr Water Info Ctr) W78-12466

#### PRELOAD DESIGNED WATER RESERVOIRS IN BOKSBURG

Municipal Engineer, Vol 8, No 4, p 55-57, 59, 1977.

Descriptors: \*Reservoir construction, Water supply, \*Prestressed concrete, \*reinforced concrete, \*Design criteria, South Africa.

The Preload system for prestressed concrete reservoirs is becoming more and more popular in South Africa. Many municipalities as well as the Rand Water Board approach Preload directly for their designs and have in fact specified Preload designed reservoirs in their tenders. Up to date some 80 tanks have been built according to the Preload system and it looks as though many more are to follow. Two of these reservoirs are currently under construction in Boksburg, one at Sunward Park and one at Impala Park. The main contractor, Peter Faber (Pty) Ltd. is able to save 30 weeks construction time by making use of this system, resulting in a considerable saving in cost for the municipality. Another cost saving factor is the fact that specialized equipment and shuttering is hired from Preload, thus avoiding capital outlay on the contractor's part. (So Afr Water Info Ctr) W78-12468

#### THE BASIC DESIGN OF JOHANNESBURG'S DIEPSLOOT OUTFALL SEWER BRIDGE STRUCTURES, WITH SPECIAL REFERENCE TO MAJOR THERMAL MOVEMENTS

For primary bibliographic entry see Field 5E. W78-12482

#### THE CRACKING OF EXPOSED CONCRETE PIPES: CAUSES AND REMEDIES

For primary bibliographic entry see Field 8F. W78-12483

#### CORROSION RESISTANCE AND DURABILITY OF ASBESTOS-CEMENT PIPES

Municipal Engineer, Vol. 8, No. 5, p 79-89, 1977. 12 ref.

Descriptors: \*Corrosion resistance, Durability, \*Asbestos cement, Pipes, Potable water, Service life, Strength, Pipelines, Sewers, Protective coating, Sewage gas, Industrial wastes, Hydrogen sulphide, Corrosion protection, Pipe joints, Soil corrosion, Deterioration, Bitumens, Epoxy resins, Abrasion, South Africa.

The article deals with questions being asked on the subject of the durability of asbestos-cement pipes in liquid corrosive media and discusses abrasion, corrosion protection (coatings); External (soil) corrosion; Industrial effluents; Domestic sewage and corrosion of joints. (So Afr Water Info Ctr) W78-12496

#### SEALING EARTH DAMS

Building and Construction (Johannesburg), June 1976, p 26.

Descriptors: \*Earth dams, \*Soil sealants, Leakage, Evaporation ponds, \*Sealants, South Africa.

The use of Hydrosal is described, a product used for sealing leaking earth dams. The product, which is a 100 per cent South African, manufactured product, is easy to lay and usually costs less than R1 per sq. metre to apply. Mention is also made of projects where this product has been used, as well as of other products in the same range that can be used for sealing metal and concrete reservoirs. (So Afr Water Info Ctr) W78-12512

#### CLASSIFICATION AND ENGINEERING PROPERTIES OF DREDGED MATERIAL

Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab. M. J. Bartos, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 768, Price codes: A09 in paper copy, A01 in microfiche. Technical Report D-77-18, September 1977. 170 p, 65 fig, 39 tab, 31 ref, 4 append.

Descriptors: \*Dredging, \*Soil properties, \*Soil classification, Compaction, Sampling, Landfills, Soil mechanics, Dewatering, Soils, Soil engineering, Grain size, \*Dredged material, \*Soil sampling, Dewatered dredged material, Soil mechanics tests, Urban development, Field conditions.

Dredged material data and classification and engineering reports were acquired from Corps of Engineers Districts, from published reports, and from a program of sampling and testing of material to be dredged. Standard soil properties tests were used to determine the classification and engineering properties of dredged material samples. Sampling test specimen preparation, and test descriptions were presented. Samples were classified in accordance with each of 4 standard soil classification systems. The engineering properties of 10 samples of compacted dredged material were determined, and the results showed that dewatered dredged material has properties comparable to those of similar types of soil. The engineering properties of dredged material in some containment areas were presented, showing the variation of properties with depth, time, and distance from the dredge discharge pipe. The study concluded that dewatered dredged material is a soil, can be analyzed as a soil, and can be used as a soil. The use of soil mechanics tests and the comparison between soil and dredged material were presented to encourage the productive use of dredged material as a natural resource in urban and other development projects, especially in areas where a landfill could be met by available dredged material. (Roberts-ISWS) W78-12621



## Field 8—ENGINEERING WORKS

### Group 8G—Materials

**WATER LEVEL ALARM APPARATUS,**  
For primary bibliographic entry see Field 4A.  
W78-12773

**DIRT FILTER FOR WATER PIPES,**  
For primary bibliographic entry see Field 5G.  
W78-12791

**DRAG REDUCTION OF DEGRADED AND BLENDED POLYMER SOLUTIONS,**  
David W. Taylor Naval Ship Research and Development Center, Bethesda, MD. Ship Performance Dept.  
For primary bibliographic entry see Field 8B.  
W78-12831

## 8I. Fisheries Engineering

**EVALUATING AQUACULTURAL USE OF THERMAL EFFLUENTS: AN APPLICATION OF SYSTEM DYNAMICS TO ENVIRONMENTAL PROBLEM SOLVING,**  
Rhode Island Univ., Narragansett. Coll. of Business Administration.  
For primary bibliographic entry see Field 5G.  
W78-12196

**HOMING OF RAINBOW TROUT TRANSPLANTED IN LAKE MICHIGAN: A COMPARISON OF THREE PROCEDURES USED FOR IMPRINTING AND STOCKING,**  
Wisconsin Univ.-Madison. Lab. of Limnology.  
A. T. Scholz, C. K. Gosse, J. C. Cooper, R. M. Horrall, and A. D. Hasler.  
Transactions of the American Fisheries Society, Vol 107, No 3, p 439-443, 1978. 2 tab, 1 fig, 16 ref.

Descriptors: \*Rainbow trout, \*Lake Michigan, Aquiculture, Wisconsin, Fish physiology, \*Fish behavior, Juvenile fish, \*Fish migration, On-site investigation, Fish management, Fish guiding, \*Fish attractants, \*Morpholine, Imprinting, Little Manitowoc River.

The homing ability of three groups of rainbow trout (*Salmo gairdneri*) stocked in Lake Michigan by different procedures was compared. One group of juvenile rainbow trout was imprinted to a synthetic chemical, morpholine, during the presmolt and smolt stages, and a second group was not imprinted. Both groups were stocked directly into Lake Michigan, 1 km north of the Little Manitowoc River. A third group of trout was retained in a pond on the Little Manitowoc River during the presmolt and smolt stages and then released into Lake Michigan at the same location as the other two groups. During the adult spawning migration, morpholine was metered into the Little Manitowoc River. This river and 16 other locations were monitored for returning fish. Themorpholine-imprinted fish returned to the Little Manitowoc River in greater numbers and strayed less than did fish from the other two treatment groups. This result is a consequence of exposure to a unique odor cue at the critical period for imprinting. (EIS-Katz)  
W78-12517

**A RESEARCH PROGRAM TO EXAMINE FISH BEHAVIOR IN RESPONSE TO HYDRAULIC FLOW FIELDS - DEVELOPMENT OF BIOLOGICAL DESIGN CRITERIA FOR PROPOSED WATER DIVERSIONS,**  
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.  
C. H. Hanson, and H. W. Li.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 992, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, Feb 1978. 23 p, 5 fig, 3 tab, 9 ref, append. OWRT C-7679 (No 7254)(1).

Descriptors: \*Water intakes, \*Fish guiding, \*Fish behavior, \*Fish barriers, Fish physiology, Water cooling, Electric power plants, Fish attractants, Hydraulic design, Design flow, Bio-energetics, \*Design criteria, \*Water diversion, \*Intake velocity, Entrapment, Impingement.

An approach is developed for deriving intake velocity design criteria based on the interaction of bioenergetics and fish behavior in velocity gradients. Agreement between estimated energetically optimal swimming speeds and the mean of observed behaviorally selected swimming speeds for juvenile chinook salmon, bluegill, and silversides was good ( $r = 0.92$ ). These results support the hypothesis that the behavioral response of fish to a hydraulic flow field is predictable in terms of an energetically optimal swimming speed for a given species and size class of fish. Physical and biological factors which influence the application of this approach to the development of design criteria which would minimize impingement losses at water intakes are discussed. Limitations of this approach and areas requiring additional research are suggested.  
W78-12602

## 9. MANPOWER, GRANTS AND FACILITIES

### 9A. Education (Extramural)

**ENHANCEMENT OF WATER RESOURCES INFORMATION TRANSFER AND RESEARCH IN VERMONT,**  
Vermont Univ., Burlington. Water Resources Research Center.  
For primary bibliographic entry see Field 10D.  
W78-12116

## 10. SCIENTIFIC AND TECHNICAL INFORMATION

### 10C. Secondary Publication And Distribution

**WISCONSIN GROUND WATER - AN ANNOTATED BIBLIOGRAPHY, 1973-1977.**  
Wisconsin Univ., Madison. Water Resources Center.  
For primary bibliographic entry see Field 2F.  
W78-12135

**BIBLIOGRAPHY OF CANADIAN GLACIOLOGY, 1975 - BIBLIOGRAPHY NO. 1, GLACIER INVENTORY NOTE NO. 10,**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
For primary bibliographic entry see Field 2C.  
W78-12252

**BIBLIOGRAPHY ON MARINE POLLUTION IN SOUTH AFRICA,**  
Council for Scientific and Industrial Research, Johannesburg (South Africa).  
For primary bibliographic entry see Field 5B.  
W78-12404

**BIBLIOGRAPHY AND INDEX OF WISCONSIN GROUNDWATER, 1851-1972: ADDENDUM 1834-1972.**  
Wisconsin Univ.-Madison. Water Resources Center.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 313, Price codes: A03 in paper copy, A01 in microfiche. Technical Report WIS WRC 78-04, 1978. 39 p. Compiled by A. Zaporozec. Addendum to Special

Report No. 2, Wisconsin Geological and Natural Survey. OWRT A-081-WIS(1), 14-34-0001-7106.

Descriptors: \*Groundwater, \*Bibliographies, \*Indexes, \*Wisconsin.

First annotated supplement to the Bibliography and Index of Wisconsin Ground Water, 1834-1972, includes 130 citations to publications on various aspects of Wisconsin's ground-water resource which were published during the year 1973 through 1977. The references were annotated from the following source materials: reports in professional and trade magazines and journals; reports, studies and unpublished material in federal, state and local files; books, documents and conference proceedings; and student theses in the University of Wisconsin libraries. The references are arranged by author for each calendar year, and accompanied by author, country, and general reference indexes. An abbreviation in the upper right corner of each entry indicates the library where the reference is located. (See also W78-12135)  
W78-12600

**THE WORLD REMOTE SENSING BIBLIOGRAPHIC INDEX,**  
Tensor Industries, Inc., Falls Church, VA.  
For primary bibliographic entry see Field 7B.  
W78-12618

**ELM-ASH-COTTONWOOD FOREST TYPE BIBLIOGRAPHY,**  
Purdue Univ., Lafayette, IN. Dept. of Forestry and Natural Resources.  
For primary bibliographic entry see Field 2I.  
W78-12681

**POLAR CONTINENTAL SHELF PROJECT. TITLES AND ABSTRACTS OF SCIENTIFIC PAPERS SUPPORTED BY PCSP.**  
Department of Energy, Mines and Resources, Ottawa (Ontario) Polar Continental Shelf Project.  
For primary bibliographic entry see Field 5C.  
W78-12819

**INVENTORY OF WATER RESOURCES RESEARCH IN AUSTRALIA, 1976.**  
Australian Water Resources Council, Canberra. Dept. of National Resources.  
For primary bibliographic entry see Field 2A.  
W78-12833

### 10D. Specialized Information Center Services

**ENHANCEMENT OF WATER RESOURCES INFORMATION TRANSFER AND RESEARCH IN VERMONT,**  
Vermont Univ., Burlington. Water Resources Research Center.  
E. A. Cassell.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 067, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, November 1977. 15 p. OWRT A-029-VT(1).

Descriptors: \*Research priorities, \*Information exchange, \*Vermont, Information transfer, Education, Research and development, Universities, \*Water Resources Institute.

Research on the water resources of Vermont is severely restricted due to limited local and state funds. The annual allotment funds of the Vermont Water Resources Research Center are thus used to focus and enhance water research in Vermont on priority problems and to establish ongoing information transfer among researchers and between researchers and the community. Objectives of this

SCIENTIFIC AND TECHNICAL INFORMATION—Field 10  
Specialized Information Center Services—Group 10D

study were: (1) enhance the effectiveness of information transfer activities of the Vermont Water Resources Research Center, (2) encourage additional research funding and advanced educational activities relating to water resources, and (3) implement techniques for increasing the impact of the Vermont Water Resources Research Center on water research, education, and information transfer activities. Specific accomplishments of the Vermont Water Resources Research Center include: (1) the initiation of an awareness program of the Water Center, (2) achieving the creation of close working relationships with State, federal and local agencies and citizen groups, (3) the sponsoring of conferences and seminars on regional and local water resource problems and research, (4) the production of slide/tape show 'Research On Lake Champlain', (5) the development of A Six Year Program for Lake Champlain Research, and (6) the execution of outside funded research by Water Center personnel.

W78-12116

This image shows a blank, aged, cream-colored page, likely an endpaper or flyleaf of a book. The paper has a slightly textured appearance with some faint smudges and discoloration, particularly towards the bottom edge. The left edge of the page shows the binding of the book, and the overall tone is a warm, off-white or light beige.



## CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Illinois State Water Survey.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

### **Supported by the Environmental Protection Agency in cooperation with WRSIC**

- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

## Subject Fields



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6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND  
FACILITIES

10 SCIENTIFIC AND TECHNICAL  
INFORMATION

## INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

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